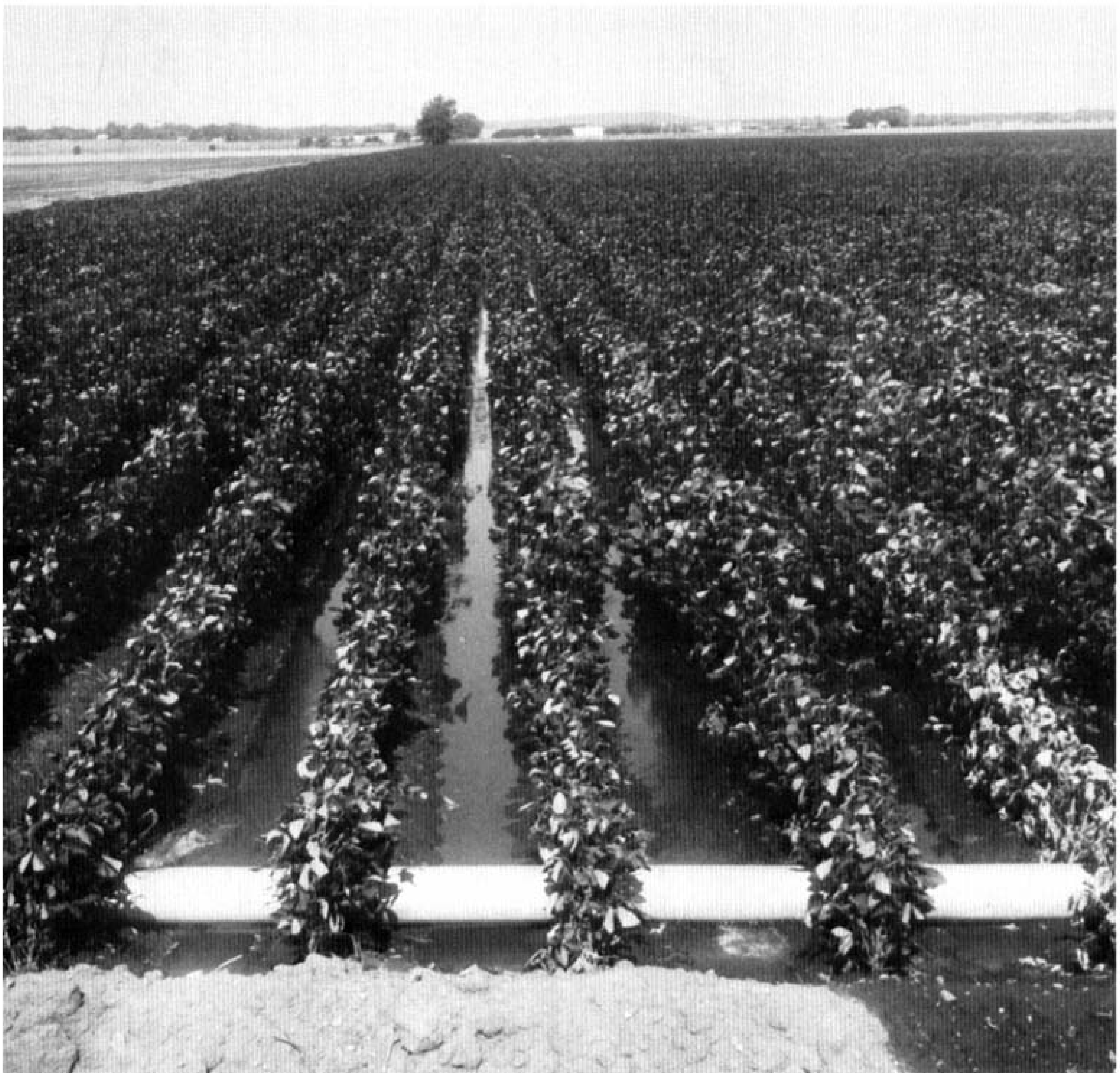
United States Department of Agriculture

Soil Conservation Service

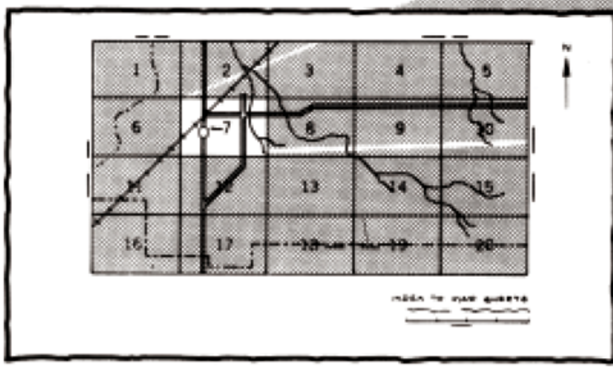
In cooperation with
U.S. Department of Agriculture, Forest Service
Oklahoma Agricultural Experiment Station
and the Oklahoma Conservation Commission

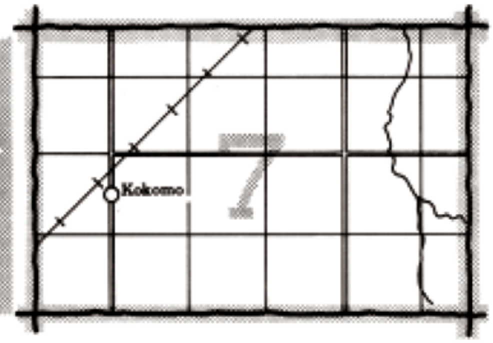
Soil Survey of Muskogee County, Oklahoma



HOW TO USE

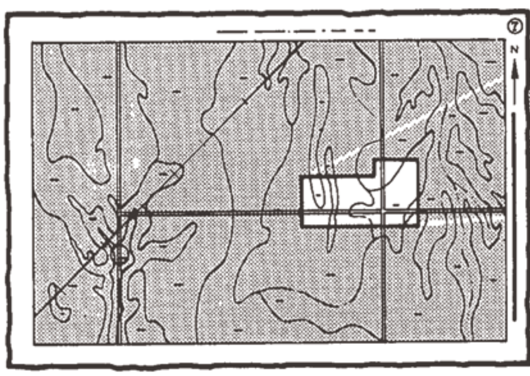
1. Locate your area of interest on the "Index to Map Sheets"

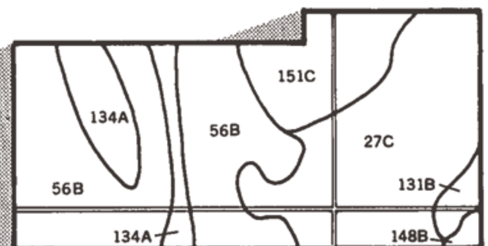




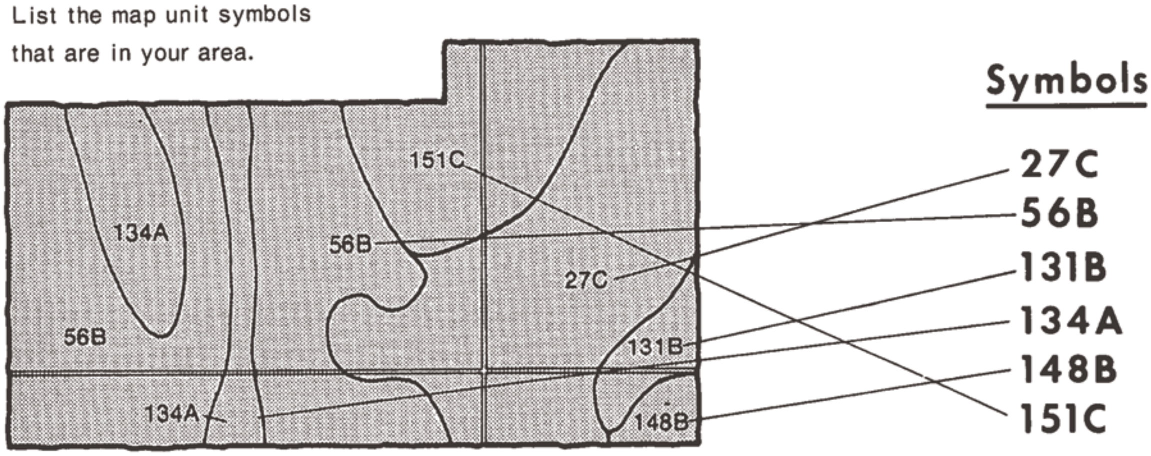
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



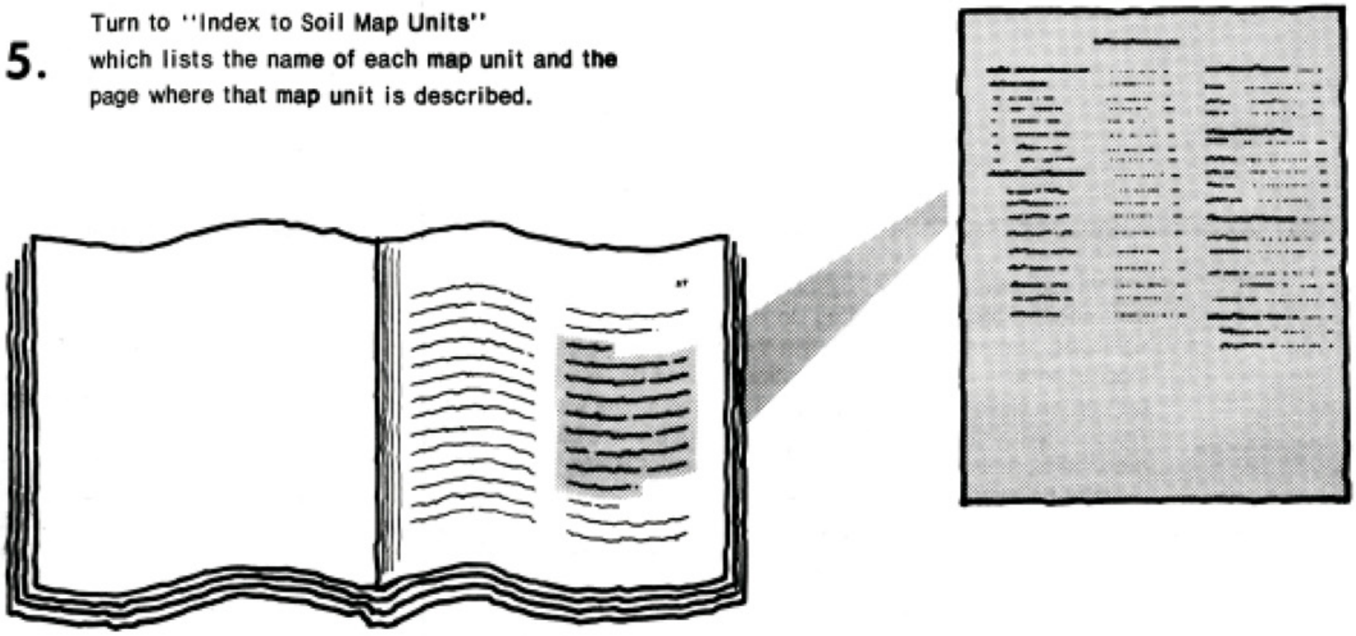


4. List the map unit symbols that are in your area.

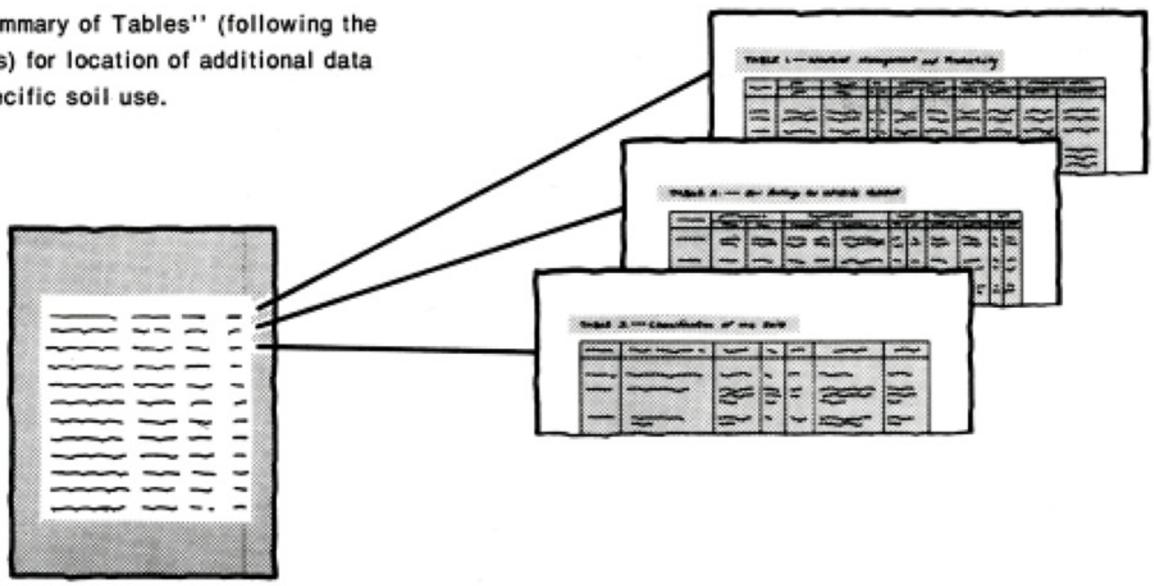


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This soil survey was made cooperatively by the Soil Conservation Service, Forest Service, Oklahoma Agricutural Experiment Station, and Oklahoma Conservation Commission. It is part of the technical assistance furnished to the Muskogee County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Soybeans is one of the main row crops in Muskogee County. This crop is on Caspiana silt loam, rarely flooded.

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Soil Series

Issued June 1988

Index to Map Units

Summary of Tables

Foreword

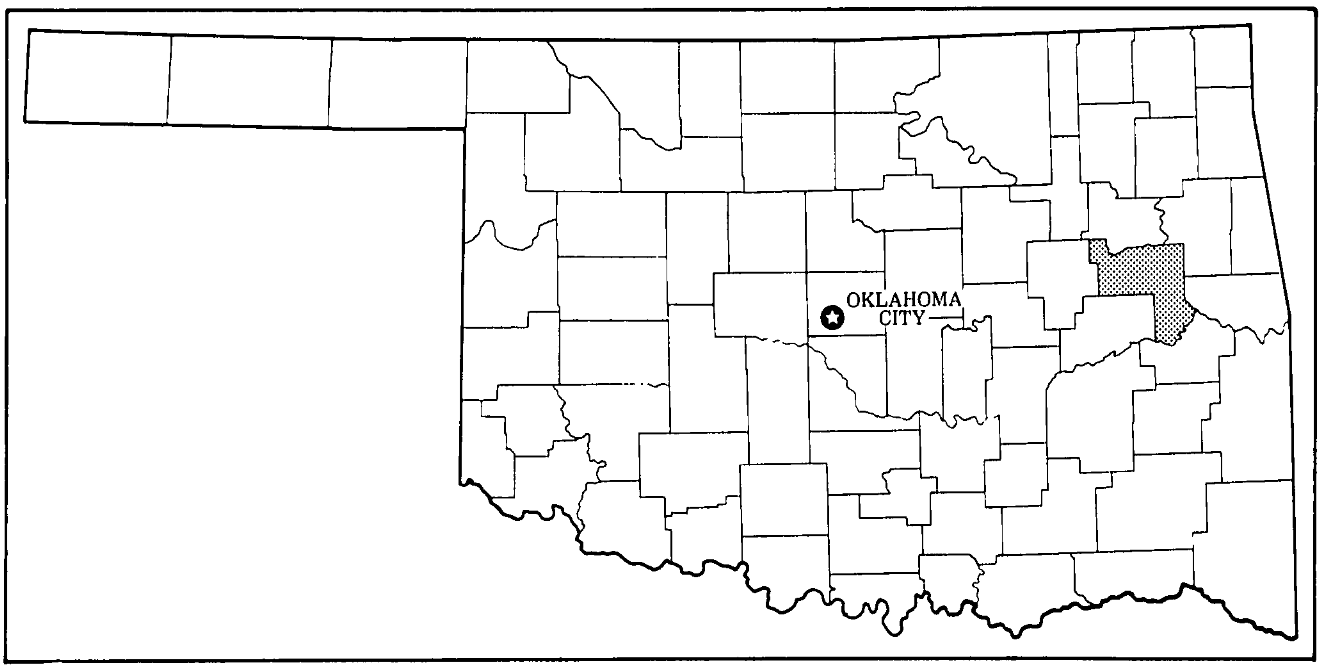
This soil survey contains information that can be used in land-planning programs in Muskogee County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Roland R. Willis
State Conservationist
Soil Conservation Service



Location of Muskogee County in Oklahoma.

Soil Survey of
Muskogee County, Oklahoma

By Mark Townsend, Roscoe Long, Gregory F. Scott, and
Randall R. Gilbertson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
and Forest Service
In cooperation with
Oklahoma Agricultural Experiment Station and
Oklahoma Conservation Commission

MUSKOGEE COUNTY is in the east-central part of Oklahoma. Muskogee, the county seat, is in the north-central part of the county. The county has an area of about 538,240 acres, or 841 square miles. The part of the Arkansas River in the county and areas of water over 40 acres make up 18,860 acres, or 3.5 percent of the total acreage. The county is bordered on the north by Wagoner and Cherokee Counties; on the east by Cherokee, Sequoyah, and Haskell Counties; on the west by Okmulgee and McIntosh Counties; and on the south by McIntosh and Haskell Counties.

General Nature of the County

This section gives general information concerning the county. It discusses physiography, settlement and development, natural resources, transportation and industry, climate, and visual resources.

Physiography

Muskogee County is mainly in the Arkansas Valley section of the Ouachita Province and in the Osage Plains section of the Central Lowlands Province. Topographic differences range from the nearly level flood plains of the Arkansas River in the northern and eastern part of the county to the moderately steep areas in the northeastern part. The general slope is toward the south and east. Most drainage is into the Arkansas and South Canadian Rivers. Elevation ranges from about 1,100 feet in the northeastern part of the county to about 450 feet in the southeastern part.

Settlement and Development

Soon after the Louisiana Purchase in 1803, traders came to the junction of the Grand, Verdigris, and Arkansas Rivers to an area called Three Forks. Union Mission, the first mission in Oklahoma, was established in 1819 on the west bank of the Grand River.

In 1824 Fort Gibson became the first military establishment in Oklahoma. It was the influence of river navigation that brought Fort Gibson to the area and that subsequently brought the Creek Indians. A Creek agency established in 1829 was the beginning of the centering of Indian administration in the area.

In 1871, the railroad came to this area, and the trading settlement at Three Forks was replaced by a village on the prairie. That village was called Muskogee for the tribe of Muscogee Indians on whose territory it was located. Muskogee became the administrative capital of the Indian Territory and has steadily grown from what once was a bald, open prairie.

The early settlement of Muskogee County was mostly by the Creek Indians. Land was allotted to the Indians on the basis of its cash value; the largest allotments were for timberland. Land could be leased for farming if supervised by the Bureau of Indian Affairs.

The sale or lease of the land attracted other settlers into the county. Most of the early settlers farmed on small subsistence acreages. In the timbered areas, the land had to be cleared before it could be cultivated. Cotton, corn, small grains, sorghums, peanuts, and alfalfa hay were the major cash crops. Some settlers sold out because they found the land too low in fertility, thus making it difficult to earn a living. Farmers in other

areas bought the land to increase the size of their farm units. They specialized in certain crops and livestock enterprises to increase efficiency. These farmers now have mechanized machinery, are using irrigation, and have converted cultivated fields to tame pasture.

Natural Resources

The natural resources of the county are mainly soil, water, timber, wild game and fish, and scenic beauty.

The soil is the most important natural resource in the county. It produces trees, crops, grass for livestock, and mineral resources. These support the dominant part of the economy in the county.

The water sources are Fort Gibson Lake, other reservoirs, and wells. Two water districts serve the county. The Arkansas River provides flood control, navigation, and recreation. Farm ponds are the source of water for livestock.

Timber production is decreasing. Most of the timber has been cut over, and the trees left to propagate the stands are of poor quality. Some areas are planted to trees. The timber is used mainly for lumber.

Shale is common in the county. It is mined for use on county roads and for commercial uses. Coal is mined in some areas, mainly in the southern part of the county. Shallow gas wells and some oil wells are located mainly in the eastern part of the county. Additional information on mineral and water resources in Muskogee County is in the Geology section.

Transportation and Industry

Muskogee County is served by a network of state and federal highways. U.S. Highways 69, 64, and 62 and the Muskogee Turnpike cross the county in a north-south direction. Interstate 40 and Oklahoma Highway 16 cross the county in an east-west direction. In farm areas, dirt, gravel, and paved roads provide access to state and federal highways. Railroads transect the county north to south and east to west. The Arkansas River Navigation System crosses the county near the eastern boundary.

Grains, peanuts, truck crops, and livestock are marketed in the survey area or in adjacent towns. Most of the industries are located near the city of Muskogee.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Muskogee, Oklahoma, in the period 1951 to 1957. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 41 degrees F, and the average daily minimum temperature is 31 degrees. The lowest temperature on record, which occurred at Muskogee on January 10, 1977, is -9 degrees F. In summer the average temperature is 80 degrees F, and the average daily maximum temperature is 92 degrees. The highest recorded temperature, which occurred at Muskogee on July 13, 1954, is 114 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 41 inches. Of this, 25 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 7.16 inches at Muskogee on July 15, 1961. Thunderstorms occur on about 50 days each year, and most occur in summer.

The average seasonal snowfall is 8 inches. The greatest snow depth at any one time during the period of record was 10 inches. On an average of 1 day, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

Visual Resources

David Thompson, landscape architect, Soil Conservation Service, assisted in the preparation of this section.

The appearance and visual qualities of Muskogee County are important and worthy of inventory, evaluation, and management. The visual resource is the definable appearance of the land form, vegetation, water elements, and manmade structures of the county. As with any natural resource, visual resources are finite and should be regarded as worthy of proper management for effective conservation. Visual resources occur in various patterns that have differing degrees of diversity ranging from low to high.

Each general soil map unit has a distinctive appearance that can be modified by altering the landscape elements or patterns. In some areas, the visual resource has been extensively changed by agricultural practices or urban expansion.

The visual diversity is described and rated in the general soil map units. These descriptions are based on a comparison of landscapes within the county and the patterns that are created by the basic landscape

elements—vegetation, landform, water, and manmade structures.

The elements and patterns of any landscape are readily visible, and the diversity of that landscape can be rated as high, medium, or low. A landscape that has high visual diversity will have some or all of the following characteristics: varied landforms, unique plant communities, varied vegetative patterns, rivers or streams or both that have high clarity, lakes or ponds that have diverse shorelines, and manmade structures that are harmonious with the landscape and other structures.

In areas of low visual diversity, one landscape element may dominate and create a continuous appearance that has little or no variation in pattern. Low diversity areas may have some of the following characteristics: landforms with no variety; vegetative cover with no variation in type, height, or color; water bodies that have limited visual interest and shorelines with no variety; and manmade structures that have very little relation to their surroundings.

When a change in landscape elements and patterns is considered, the potential visual impact on the landscape should be carefully analyzed. Often a single practice can increase or decrease the visual resource quality. For example, the grading and revegetating of an eroded area can increase visual resource quality, but when a sloping area of soils suitable for use as woodland is cleared and planted to row crops, a decrease in visual resource quality is often experienced. The soil may erode severely during the winter months if it is not protected by vegetative cover. The result could be bare and unsightly eroded areas, loss of soil, decrease in water quality caused by the silt load, and loss of vegetation in other areas because of runoff.

A knowledge of each map unit and the influence that land use changes make in an area is necessary to effectively plan for proper visual resource management. Assistance for resource planning is available from the Soil Conservation field office in Muskogee County. Proper consideration of soil characteristics, land use, and the visual elements helps to enhance or preserve the optimum quality of the landscape resources.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production

records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, tame pasture, native grass,* and *urban uses.* Cultivated crops are those grown extensively in the survey area. Tame pasture refers to areas of introduced grasses. Native grass refers to areas of native grasses. Urban uses include residential, commercial, and industrial developments.

1. Dennis-Bates-Coweta

Deep to shallow, nearly level to strongly sloping, moderately well drained to somewhat excessively drained soils that have a loamy surface layer and a loamy or clayey subsoil; on uplands

This map unit consists of soils that are very gently sloping to moderately steep. The soils are on moderately long, smooth slopes on uplands (fig. 1). They are drained by small streams. Slopes range from 1 to 15 percent.

The nearly level to moderately steep slopes of the landforms in this map unit and occasional sandstone rock outcrops provide some diversity. Vegetative patterns are varied. They include tame pasture, cultivated crops, and native grasses. Water features consist of farm ponds and streams that are major drainageways. Structures are farmsteads and residential units. Other land uses are oil and gas production, coal strip mining, and flagstone production. The visual diversity is medium, indicating that changes on the landscape generally will be moderately insignificant.

This map unit makes up about 36 percent of the county. It is about 44 percent Dennis soils, and about 24 percent Bates soils, about 9 percent Coweta soils, and about 23 percent soils of minor extent.

Dennis soils are on smooth, convex side slopes of uplands. These soils are deep, nearly level to moderately sloping, moderately well drained, and slowly permeable. They have a loamy surface layer and a clayey subsoil.

Bates soils are in higher positions than Dennis soils on smooth, slightly convex side slopes. Bates soils are moderately deep, very gently sloping and gently sloping, well drained, and moderately permeable. They have a loamy surface layer and a loamy subsoil. These soils formed in residuum weathered from sandstone and thin layers of shale.

Coweta soils are on convex ridges and side slopes of uplands. These soils are shallow, very gently sloping to strongly sloping, well drained and somewhat excessively drained, and moderately permeable. They have a loamy surface layer and subsoil underlain by soft sandstone.

Of minor extent are the Choteau, Eram, Kanima, Parsons, Taloka, and Verdigris soils and urban land. The deep Choteau, Parsons, and Taloka soils are on slopes below Dennis soils. The moderately deep Eram soils are on slightly convex side slopes with the Coweta soils. The deep Kanima soils formed in deposits of strip mine operations. The deep, loamy Verdigris soils are in drainageways. Urban land is mapped in complex with the Dennis soils.

The soils of this map unit are used mainly for native grasses or tame pasture. In a few areas, Dennis and Bates soils are used for grain sorghum, small grains, and soybeans.

The soils of this map unit have high potential for crops. The crops respond favorably to good management. The main concerns in management are controlling erosion and maintaining soil tilth and fertility. Terraces and residue management help control erosion.

Potential of these soils is high for native grasses and tame pasture. Rotation grazing and prevention of overgrazing are necessary.

Figure 1.—Soils of the Dennis-Bates-Coweta general soil map unit form a somewhat diverse landscape of tame pastures and native grasses.

These soils have low potential for most urban uses. Shrinking and swelling of the Dennis soils, moderate soil depth in the Bates soils, and shallow soil depth in the Coweta soils are the main limitations for most urban uses.

2. Taloka-Parsons-Stigler

Deep, nearly level and very gently sloping, somewhat poorly drained and moderately well drained soils that have a loamy surface layer and a clayey subsoil; on uplands and terraces

This map unit consists of soils that are nearly level and very gently sloping. These soils are on broad, smooth uplands and high terraces on prairies. In a few areas, small streams are entrenched in the landscape. Slopes range from 0 to 3 percent.

There are no prominent landforms in this map unit. The nearly level to very gently sloping slopes provide limited diversity. Vegetative patterns consist of native grasses and wheat, and water features are farm ponds and scattered drainageways. Structures are farmsteads and residences. The visual diversity is low, and changes occurring on the landscape will be visually significant.

This map unit makes up about 28 percent of the county. It is about 32 percent Taloka soils, about 22 percent Parsons soils, about 21 percent Stigler soils, and about 25 percent soils of minor extent.

Taloka soils are on broad, smooth uplands or high terraces. These soils are deep, nearly level and very gently sloping, somewhat poorly drained, and very slowly permeable. They have a loamy surface layer and a clayey subsoil.

Parsons soils are on broad, smooth uplands and terraces. These soils are deep, nearly level and very gently sloping, somewhat poorly drained, and very slowly

permeable. They have a loamy surface layer and a clayey subsoil.

Stigler soils are on broad, smooth uplands and terraces. These soils are deep, nearly level and very gently sloping, moderately well drained, and very slowly permeable. They have a loamy surface layer and a clayey subsoil.

The soils of minor extent are the Choteau, Dennis, Okemah, and Woodson soils. The Choteau, Dennis, and Okemah soils are deep and moderately well drained. They are in slightly higher positions than the Stigler soils. The Woodson soils are deep and somewhat poorly drained. They are on the same landscape.

The soils of this map unit have high potential for crops. Concerns in management include preventing erosion, maintaining soil tilth and fertility, and improving water intake. Crops respond to fertilizer, and crop residue management helps maintain soil tilth. Terraces are needed for these soils where slopes exceed 1 percent. Proper row direction helps drainage in small concave areas.

The soils of this map unit have high potential for native grasses and tame pasture. The concerns in management are proper grazing and preventing wildfires.

These soils have low potential for most urban uses. Low strength, wetness, and the high shrink-swell potential are the main limitations.

3. Enders-Hector-Linker

Deep to shallow, moderately sloping to very steep, well drained soils that have a loamy surface layer and a clayey or loamy subsoil; on uplands

This map unit consists of soils that are moderately sloping to very steep. These soils are on hills and ridges. The hills have moderately long slopes that have a few rock outcrops on the ridges. Streams are deeply entrenched between the ridges. Slopes range from 5 to 50 percent.

The landforms of this map unit have a high degree of diversity because of the slope and many sandstone outcrops. Vegetative patterns vary moderately. The majority of the map unit is woodland and grassland; a small part is in tame pasture. Water features are limited to drainageways. Structures are primarily homesite developments. The visual diversity is high, and changes occurring on the landscape will be visually insignificant under most circumstances.

This map unit makes up about 13 percent of the county. It is about 27 percent Enders soils, about 18 percent Hector soils, about 15 percent Linker soils, and about 40 percent soils of minor extent.

Enders soils are on convex side slopes on uplands below or between areas of Hector soils. Enders soils are deep, strongly sloping to steep, well drained, and very slowly permeable. They have a loamy surface layer and a clayey subsoil underlain by shale.

Hector soils are on convex ridges and side slopes of uplands. These soils are shallow, moderately sloping to very steep, well drained, and moderately rapidly permeable. They have a loamy surface layer and subsoil underlain by sandstone.

Linker soils are on convex ridges and side slopes of uplands. These soils are moderately deep, very gently sloping to moderately steep, well drained, and moderately permeable. They have a loamy surface layer and subsoil underlain by sandstone.

The soils of minor extent are the Endsaw, Oktaha, and Shermore soils. The Endsaw soils are moderately deep to deep. They are on moderately steep to steep, convex side slopes. The Oktaha soils are moderately deep. They are on smooth, broad ridges. The Shermore soils are deep and loamy. They are on gently sloping, convex foot slopes.

Land uses are limited because of the rough topography and shallow soils. The soils of this map unit are used mainly as woodland. In some areas, they are used for tame pasture. The soils are also used for recreational activities, such as hunting, hiking, and off-road vehicles. They are well suited to use as habitat for wildlife.

The soils of this map unit have low potential for most cultivated crops. Some of the minor soils that have slopes of 8 percent or less are used for crops. The main concerns in management are controlling erosion and maintaining fertility.

The soils of this map unit have low potential for tame pasture and medium potential for native grasses. The quality of grass can be improved by proper stocking, controlled grazing, and preventing wildfires.

These soils have low potential for most urban uses. Soil depth, stony surfaces, slopes, and the high shrink-swell potential are the main limitations.

4. Oktaha-Hector

Moderately deep and shallow, very gently sloping and gently sloping, well drained soils that have a loamy surface layer and a loamy subsoil; on uplands

This map unit consists of soils that are very gently sloping and gently sloping. These soils are on low, convex hills and ridges. The hills have moderately long slopes that have a few rock outcrops on the ridges. Streams are slightly entrenched between the ridges. Slopes range from 1 to 5 percent.

The landforms of this map unit have a wide diversity because of the slope. Deciduous hardwood trees mixed with pasture and farmland provide diversity in the vegetative patterns. Water features are farm ponds and drainageways. Structures are farmsteads and some rural residences. Visual diversity is high, and changes on the landscape will be visually insignificant.

This map unit makes up about 6 percent of the county. It is about 74 percent Oktaha soils, about 7 percent Hector soils, and about 19 percent soils of minor extent.

Oktaha soils are on smooth, convex side slopes on low ridges below or between areas of Hector soils. Oktaha soils are moderately deep, very gently sloping and gently sloping, well drained, and moderately permeable. They have a loamy surface layer and subsoil underlain by sandstone.

Hector soils are on low, convex hills and ridges of uplands. These soils are shallow, very gently sloping and gently sloping, well drained, and moderately rapidly permeable. They have a loamy surface layer and loamy subsoil underlain by sandstone.

The soils of minor extent are the Enders, Linker, and Shermore soils. The Enders soils are moderately deep to deep. They are on steeper convex side slopes than the Oktaha and Hector soils. The Linker soils are moderately deep and are on lower convex side slopes. The Shermore soils are deep and loamy and are on convex foot slopes.

The soils of this map unit are used mainly as woodland. In some areas they are used for tame pasture. These soils are well suited to recreation uses and to use as habitat for wildlife.

The soils of this map unit have low potential for most cultivated crops, but most of the soils can be used for crops. The main concerns in management are controlling erosion and maintaining fertility.

The soils of this map unit have low potential for tame pasture and medium potential for native grasses. The quality and quantity of forage can be improved by proper stocking, controlled grazing, fertilizing, and preventing wildfires.

These soils have low potential for most urban uses. Soil depth is the main limitation.

5. Severn-Kiomatia-Roebuck

Deep, nearly level to moderately sloping, well drained or somewhat poorly drained soils that have a loamy, sandy, or clayey surface layer and loamy or sandy underlying layers or a clayey subsoil; on flood plains

This map unit consists of soils that are smooth and nearly level to moderately sloping. These soils are on flood plains of major streams and rivers. Slopes range from 0 to 6 percent.

The landforms of this map unit are limited to the nearly level to sloping flood plains along the Arkansas River. Hardwood forests along the river and in game preserves occupy about 10 percent of the map unit; the remainder is in cultivated crops and tame pasture. Water features consist of drainageways and the Arkansas River. Structures are farmsteads, Lock and Dam, and Port of Muskogee. The visual diversity is medium, and changes occurring on the landscape will be moderately significant.

This map unit makes up about 7 percent of the county. It is about 21 percent Severn soils, 17 percent Kiomatia soils, 15 percent Roebuck soils, and 47 percent soils of minor extent.

Severn soils are on broad, smooth flood plains. These soils are deep, nearly level to sloping, and well drained. They are moderately rapidly permeable. Seven soils have a very fine sandy loam surface layer underlain by very fine sandy loam that has thin layers of silty clay loam, silt loam, and fine sandy loam. These soils are rarely flooded.

Kiomatia soils are on the lowest part of the flood plain. These soils are deep, nearly level and very gently sloping, and well drained. They are rapidly permeable. Kiomatia soils have a sandy surface layer and stratified sandy underlying layers. These soils range from rarely flooded to frequently flooded.

Roebuck soils are in slight depressions on low terraces. Theses soils are deep, nearly level, and somewhat poorly drained. They are very slowly permeable. Roebuck soils have a clayey surface layer and a clayey subsoil. These soils range from frequently flooded to rarely flooded.

The soils of minor extent are Barge, Caspiana, Garton, Keo, Mason, Norwood, and Roxana soils. These soils are deep, and except for the Garton soils, they are well drained. The Garton soils are moderately well drained. The Barge soils are recent spoil bank along the Arkansas river. Caspiana and Mason soils are on stream terraces. Garton soils are in slightly higher positions than the Roebuck soils, and the Keo soils are in swales and on low ridges of flood plains. Norwood soils are on high bottom lands of flood plains, and Roxana soils are on natural levees of flood plains.

The soils of this map unit that are not subject to frequent flooding have high potential for crops. Concerns in management include controlling erosion, flooding, and wetness; maintaining soil tilth and fertility; and improving water intake. Fertilizer, drainage, and crop residue management are needed. Proper row direction helps drainage in concave areas.

The soils of this map unit have high potential for native grasses and tame pasture. Controlling brush, proper grazing, and preventing wildfires are the main concerns in management.

These soils have low potential for most urban uses because of flooding.

6. Verdigris-Lightning

Deep, nearly level, moderately well drained and somewhat poorly drained soils that have a loamy surface layer and loamy underlying layers or a loamy and clayey subsoil; on flood plains

This map unit consists of soils that are smooth and nearly level. These soils are on flood plains of major streams. Slopes range from 0 to 1 percent.

There are no prominent landforms in this map unit. Slopes are nearly level and do not provide diversity. A

large part of this map unit is in tame pasture, and the remainder is in timber and cultivated crops. Vegetative patterns provide some diversity. Water features are drainageways and perennial streams. Structures are common and include several small communities along with farmsteads and residences. The visual diversity is medium, and changes occurring on the landscape will be moderately significant.

This map unit makes up about 5 percent of the county. It is about 68 percent Verdigris soils, about 13 percent Lightning soils, and about 19 percent soils of minor extent.

Verdigris soils are on smooth flood plains. These soils are deep, nearly level, moderately well drained, and moderately permeable. Verdigris soils are loamy throughout. They range from rarely flooded to frequently flooded.

Lightning soils are on smooth flood plains. These soils are deep, nearly level, somewhat poorly drained, and very slowly permeable. Lightning soils have a loamy surface layer and a loamy or clayey subsoil. These soils are occasionally flooded.

The soils of minor extent are the Caspiana, Cupco, Kiomatia, Mason, Muldrow, and Osage soils. Caspiana and Mason soils are on stream terraces. They are deep and nearly level. Cupco soils are deep, loamy, and somewhat poorly drained. They are on flood plains of local streams. Kiomatia soils are on the lowest part of the flood plain and are deep, sandy, and nearly level to slightly undulating. Muldrow soils are in slight depressions on low terraces. They are deep, loamy, somewhat poorly drained, and nearly level. Osage soils are deep, clayey, and poorly drained. They are on flood plains of local streams.

The soils of this map unit are used mainly for tame pasture or as woodland. In some areas they are used for cultivated crops, and in other areas they have been seeded to grains that are used for feeding wildlife.

The soils of this map unit that are not subject to frequent flooding have high potential for crops. The main concerns in management are flooding, wetness, and maintenance of soil tilth and fertility. Fertilizer, drainage, and crop residue management are needed.

The soils of this map unit have high potential for tame pasture and native grasses. Controlling brush, proper grazing, and preventing wildfires are the main concerns in management.

These soils have low potential for most urban uses. Flooding is the main limitation.

7. Kamie-Larton

Deep, nearly level to strongly sloping, well drained soils that have a loam or sandy surface layer and a loamy subsoil; on high terraces

This map unit consists of soils that are nearly level to strongly sloping. These soils are on broad, smooth terraces. In some areas, streams are entrenched in the landscape. Slopes range from 1 to 12 percent.

The landforms of this map unit have limited diversity. Slopes are nearly level to strongly sloping, and there are no prominent geologic formations. Vegetative patterns are limited. Occasional areas of native grasses or woodland interrupt the prevalent land use of tame pasture or grain production. Water features are limited to minor drainageways. Structures are common and include factories, farmsteads, and some residences. The visual diversity is low, and changes in the landscape will be visually significant.

This map unit makes up about 5 percent of the county. It is about 42 percent Kamie soils, about 30 percent Larton soils, and about 28 percent soils of minor extent.

Kamie soils are on broad, smooth terraces. These soils are deep, very gently sloping to moderately sloping, well drained, and moderately permeable. The Kamie soils have a loamy surface layer and a loamy subsoil.

Larton soils are on broad, smooth terraces. These soils are deep, nearly level to strongly sloping, well drained, and moderately permeable. The Larton soils have a sandy surface layer and a loamy subsoil.

The soils of minor extent are the Glenpool, Caspiana, Mason, Okay, and Tullahassee soils. Except for the Tullahassee soils, these soils are on broad smooth terraces. The Tullahassee soils are on flood plains. The Glenpool soils are deep, sandy, and somewhat excessively drained. The Caspiana, Mason, and Okay soils are deep, loamy, and well drained. The Tullahassee soils are deep, sandy, and somewhat poorly drained.

The soils of this map unit are used mainly for tame pasture. In a few areas, they are used as woodland, and in many small areas, they are used for cultivated crops. Truck crops are grown on some of the more sandy soils.

The soils of this map unit have medium potential for crops and respond to good management. The main concerns in management are controlling erosion and maintaining soil tilth and fertility.

Potential of these soils is medium for tame pasture and native grasses. The main concerns in management are proper grazing, preventing wildfires, and controlling brush.

These soils have high potential for most urban uses. Seepage is a limitation for sewage lagoons on the Larton soils.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Dennis silt loam, 1 to 3 percent slopes, is one of several phases in the Dennis series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bates-Coweta fine sandy loams, 1 to 3 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Endsaw-Hector association, steep, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

1—Barge silt loam, 3 to 30 percent slopes. This soil is deep, well drained, and gently sloping to steep. It is on spoil banks of dredged material along the Arkansas and Verdigris Rivers. Slopes range from 3 to 30 percent. Individual areas are long and narrow and range from 10 to 40 acres.

Typically, the surface layer is brown silt loam about 7 inches thick. The underlying material is reddish brown silty clay loam to a depth of at least 60 inches.

Natural fertility is medium, and the organic matter content is low. Reaction is neutral or mildly alkaline in the surface layer. Permeability is moderately slow, and surface runoff is rapid. The available water capacity is high. Root development is unrestricted throughout the soil.

Included with this soil in mapping are a few intermingled areas of soils that typically have less clay in the underlying material. The included soils make up about 20 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Barge soil is used mainly as habitat for wildlife. It has medium potential for producing habitat for openland and woodland wildlife.

This soil has low potential for cultivated crops, and it is not suited to any commonly grown crops. Erosion is a severe hazard.

This soil has medium potential for tame pasture. It is suited to bermudagrass and weeping lovegrass. Use of this soil for pastureland or hayland is effective in controlling erosion.

This soil has medium potential for growing trees for windbreaks or environmental plantings. In some areas of this soil, slope is a limiting factor for growing trees.

Potential is low for most urban uses. Steepness of slopes is the main limitation for septic tanks, small buildings, and roads and streets. Onsite investigation is essential to properly evaluate and plan the development of specific sites.

This Barge soil is in capability subclass VIe. It is not assigned to a range site.

2—Bates loam, 1 to 3 percent slopes. This soil is moderately deep, very gently sloping, and well drained. It is on smooth, slightly convex uplands. Most areas are 50 to 450 acres, but some areas are smaller.

Typically, the surface layer is very dark grayish brown loam about 12 inches thick. The subsoil extends to a depth of 35 inches. To a depth of 20 inches it is brown loam, and to a depth of 30 inches it is yellowish brown sandy clay loam. Below that, the subsoil is yellowish brown loam. The underlying material is soft sandstone that has thin beds of soft shale.

The soil is high in natural fertility, and the organic matter content is moderate or moderately high. Reaction of the surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. The available water capacity is high to very high, and permeability is moderate. This soil can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Dennis and Coweta soils. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

This Bates soil is used equally as rangeland and cropland. Native vegetation consists of tall grasses with scattered persimmon and sumac. The main crops are small grains, soybeans, and bermudagrass. In other areas, this soil is used for recreational activities and as habitat for wildlife.

This soil has high potential for cultivated crops. The main concerns in management are maintaining soil fertility and controlling erosion. Most crops that produce large amounts of residue can be grown continuously where residue is returned to the soil. Additions of plant food increase plant growth and provide more plant residue to reduce the loss of soil from water erosion. Excessive tillage needs to be avoided. Terraces and farming on the contour also help control water erosion.

This Bates soil has high potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer can increase growth of tame pasture plants.

This soil has medium potential for most urban uses. Limitations for dwellings without basements or small commercial buildings are insignificant. The depth to bedrock is a limitation for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or adding suitable fill material. Depth to bedrock is also the main limitation for sewage lagoons, dwellings with basements, and sanitary landfills. The moderate low strength of this soil is the main limitation for roads and streets.

This Bates soil is in capability subclass IIe and in the Loamy Prairie range site.

3—Bates loam, 3 to 5 percent slopes. This soil is moderately deep, gently sloping, and well drained. It is on slightly convex, smooth uplands. Most areas are 20 to 65 acres, but some areas are smaller.

Typically, the surface layer is very dark grayish brown loam about 11 inches thick. The subsoil extends to a depth of 36 inches. To a depth of 17 inches it is very dark grayish brown loam, and to a depth of 26 inches it is yellowish brown loam. Below that, the subsoil is yellowish brown clay loam. The underlying material is weathered, soft sandstone.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is high to very high. This soil has good tilth, and it can be worked throughout a wide range of moisture content.

Included with this soil in mapping are the Coweta and Dennis soils and soils that are similar to the Bates soil except they have a redder subsoil. The Dennis soils are on lower slopes than Bates soil, and Coweta soils are on the crest of ridges. The included soils make up about 22 percent of the map unit, but areas of these soils are less than 3 acres.

This Bates soil is used mainly for tame pasture and native grasses. In a few areas, it is used for grain sorghums, small grains, and soybeans.

This Bates soil is suited to the commonly-grown crops in the county, including small grains, grain sorghums, soybeans, introduced grasses, and native grasses.

This soil has medium potential for cultivated crops. The main concerns in management are to maintain fertility and tilth and to control loss of soil through erosion. Cropping systems need to provide for the return of adequate amounts of residue to the soil. Erosion can be reduced by contour farming, terracing, and managing crop residue. Vegetative cover is needed during the winter and spring to help keep the soil from eroding. Fertilizer increases plant growth and thus provides additional crop residue for erosion control. Terraces,

contour tillage, and cover crops are especially needed if row crops are grown. Excessive tillage needs to be avoided.

This soil has high potential for native grasses and medium potential for tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has medium potential for most urban uses. In areas of this soil used as sites for dwellings with basements, sanitary landfills, and septic tank absorption fields, the main soil feature to consider is depth to bedrock. Soil reaction needs to be considered in areas used for concrete pipe. Limitations for dwellings without basements and small commercial buildings are insignificant.

This Bates soil is in capability subclass IIIe and in the Loamy Prairie range site.

4—Bates loam, 2 to 5 percent slopes, eroded. This soil is moderately deep, very gently sloping or gently sloping, and well drained. In about 40 percent of the area, the surface layer and material from the upper part of the subsoil are mixed by plowing. A few crossable gullies are about 300 feet apart. Rill erosion is common between the gullies. Slopes are smooth and convex. Individual areas are mainly 10 to 50 acres, but some areas are smaller.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil to a depth of 25 inches is strong brown clay loam, and to a depth of 35 inches it is brown clay loam. The underlying material is weathered, soft sandstone.

This soil is medium in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. The available water capacity is high to very high. This soil has good tilth, and it can be worked throughout a wide range of moisture content.

Included with this soil in mapping are the Dennis and Coweta soils. Dennis soils are on lower slopes than Bates soil, and Coweta soils are on crests of ridges. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Bates soil is used mostly for tame pasture plants and native grasses. In a few areas, it is used for grain sorghums, soybeans, and wheat. In other areas, this soil is used for recreational activities and as habitat for wildlife.

This soil has medium potential for cultivated crops. The main concerns in management are controlling soil erosion and maintaining soil fertility and tilth. Terracing, contour farming, and returning crop residue to the soil help control erosion. Conservation tillage is also needed. Row crops need to be planted in rotation with small grains to protect the soil from water erosion. Tame pasture grasses that include legumes or native grasses are the best protection against erosion.

This soil has high potential for native grasses and medium potential for tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has medium potential for most urban uses. The main soil feature to consider is depth to bedrock in areas where this soil is used for dwellings with basements, sanitary landfills, and septic tank absorption fields. Soil reaction needs to be considered where this soil is used for concrete pipe. Limitations for dwellings without basements and small commercial buildings are insignificant.

This Bates soil is in capability subclass IIIe and in the Loamy Prairie range site.

5—Bates-Coweta fine sandy loams, 1 to 3 percent slopes. This map unit consists of small areas of Bates and Coweta soils that are so intermingled that they can not be separated at the scale used for the maps at the back of this publication. These soils are well drained and somewhat excessively drained and moderately deep to shallow. They are on side slopes, foot slopes, and ridge crests. Most areas are about 1,000 feet wide and range from 10 to 100 acres, but individual areas of each soil are 0.25 acre to 3 acres.

Bates fine sandy loam makes up 45 to 55 percent of each mapped area. Typically, the surface layer is dark brown fine sandy loam about 10 inches thick. The subsoil is dark brown loam to a depth of 14 inches and dark brown sandy clay loam to a depth of about 25 inches. The underlying material is soft, fractured sandstone.

Bates soil is medium in natural fertility, and the organic matter content is moderate. The surface layer is slightly acid to strongly acid. Permeability is moderate, and the available water capacity is high.

Coweta fine sandy loam makes up 35 to 45 percent of each mapped area. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. Below the surface layer is reddish brown loam to a depth of about 15 inches. The underlying material is soft sandstone interbedded with shale.

Coweta soils is medium in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is slightly acid or medium acid. Permeability is moderate, and the available water capacity is moderate.

Included in mapping are small intermingled areas of soils similar to the Bates soil except they have a red subsoil. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

The soils of this map unit are used mostly for tame pasture and wheat. In some areas, they are used for native grasses.

These soils have medium potential for cultivated crops. The main concerns in management are controlling erosion, improving water intake, and maintaining soil structure and fertility. Fertilizing is needed to obtain large amounts of crop residue. The residue needs to be returned to the soil to improve water intake and maintain soil tilth and fertility. Terraces, contour tillage, and close-growing crops help to control erosion. Conservation tillage is also needed. Rowcropping should be avoided to prevent excessive loss of soil by erosion.

These soils have high potential for native grasses and medium potential for tame pasture. The quality and quantity of forage can be improved by protecting from wildfires, controlling brush, and proper grazing. Fertilizer on tame pastures can also increase the amount of forage.

These soils have low potential for most urban uses because of the depth to bedrock in the Coweta soil. This limitation is difficult to correct.

These Bates and Coweta soils are in capability subclass IIIe. Bates soil is in the Loamy Prairie range site, and Coweta soil is in the Shallow Prairie range site.

6—Bates-Coweta fine sandy loams, 3 to 5 percent slopes. This map unit consists of small areas of Bates and Coweta soils that are so intermingled that they can not be separated at the scale used for the maps at the back of this publication. These soils are well drained and somewhat excessively drained and are moderately deep to shallow. They are on side slopes and crests of ridges. Most areas are about 1,000 feet wide and range from 10 to 100 acres, but individual areas of each soil are 0.25 acre to 3 acres.

Bates fine sandy loam makes up 40 to 55 percent of each mapped area. Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is dark brown loam to a depth of 14 inches and dark brown sandy clay loam to a depth of about 24 inches. The underlying material is soft sandstone to a depth of about 40 inches.

Bates soil is medium in natural fertility, and the organic matter content is moderate. The surface layer is slightly acid to strongly acid. Permeability is moderate, and the available water capacity is high.

Coweta fine sandy loam makes up 30 to 40 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. Below the surface layer is yellowish brown loam to a depth of about 15 inches. The underlying material is sandstone to a depth of 30 inches.

Coweta soil is medium in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is slightly acid or medium acid. Permeability is moderate, and the available water capacity is moderate.

Included with these soils in mapping are small areas of soils similar to the Bates soil except they have a red subsoil. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

The soils of this map unit are used mostly for tame pasture and wheat. In some areas, they are used for native grasses.

These soils have low potential for cultivated crops. The main concerns in management are controlling erosion, improving water intake, and maintaining soil structure and fertility. Fertilizing is needed to obtain large amounts of crop residue. All crop residue should be returned to the soil to improve water intake and maintain soil tilth and fertility. Terraces, contour tillage, and close-growing crops are needed to control erosion. Conservation tillage is also needed. Rowcropping should be avoided to prevent excessive loss of soil by erosion. Use of this soil for native grasses or tame pasture plants is the best protection against erosion.

These soils have high potential for native grasses and medium potential for tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, proper grazing, and protecting from wildfires. Tame pasture production can be improved by fertilizing the soil.

These soils have low potential for most urban uses because of the depth to bedrock in the Coweta soil. This limitation is difficult to correct.

These Bates and Coweta soils are in capability subclass IVe. Bates soil is in the Loamy Prairie range site, and Coweta soil is in the Shallow Prairie range site.

7—Caspiana silt loam, rarely flooded. This soil is deep, well drained, and nearly level. It is on terraces of the Arkansas River. Slopes are 0 to 1 percent and are smooth and slightly convex. Individual areas are mostly 15 to 150 acres, but some areas are smaller.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of 57 inches. To a depth of about 18 inches it is dark brown silt loam, and to a depth of about 48 inches it is reddish brown silty clay loam. Below that, the subsoil is reddish brown silt loam. The underlying material is yellowish red silt loam to a depth of about 71 inches.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is medium acid to neutral. Permeability is moderate, and the available water capacity is high to very high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are areas of the Verdigris and Muldrow soils. The Verdigris soils are on narrow flood plains, and the Muldrow soils are in slight depressions on terraces. The included soils make up

about 10 percent of the mapped areas, but areas of these soils are generally less than 3 acres.

This Caspiana soil is mainly used for crops, such as wheat, soybeans, grain sorghum, and vegetables. It is also used for tame pasture plants.

This soil has high potential and is mainly used for row crops and small grains. Management practices are needed to maintain or improve soil structure and fertility. Crop residue needs to be returned to the soil, and excessive tillage should be avoided.

This soil has high potential for native grasses and tame pasture. A mixture of bermudagrass or tall fescue and clovers is most commonly used for tame pasture. Controlling brush, proper grazing, fertilizing, and protecting from wildfires improve the quality and quantity of forage.

This soil has medium potential for most urban uses. Permeability is a limitation for septic tank absorption fields, and seepage is a limitation for sewage lagoons. Flooding is a hazard if this soil is used for trench sanitary landfills. Low strength and the hazard of flooding are the main limitations for dwellings, small commercial buildings, and roads and streets. Most of these limitations can be overcome by better structural design or by altering the soil.

This Caspiana soil is in capability class I and in the Loamy Bottomland range site.

8—Choska silt loam, rarely flooded. This soil is deep, nearly level, and well drained. It is on broad, smooth flood plains that are rarely flooded. Most areas are 30 to 200 acres, but some areas are smaller.

Typically, the surface layer is dark brown silt loam about 14 inches thick. The subsoil, to a depth of 50 inches, is yellowish red silt loam. The underlying material is yellowish red very fine sandy loam.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is slightly acid to mildly alkaline. Additions of plant food are needed for most crops. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Severn and Mason soils. These soils make up about 10 percent of the map unit. Also included are soils similar to the Choska soil except the subsoil and underlying material are more clayey. The included soils make up about 15 percent of this map unit, but areas of these soils are less than 3 acres.

This Choska soil is suited to all crops commonly grown in the area. The main crops are wheat, grain sorghum, soybeans, vegetable crops, and tame pasture plants. This soil is also suited to use as woodland.

This soil has high potential and is mainly used for cultivated crops. Soil management is needed to maintain soil tilth and fertility. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and most of the crop residue is returned to the soil. Fertilizing helps to maintain organic matter content, good tilth, and fertility.

This soil has high potential for native grasses and tame pasture. Bermudagrass is the most common pasture grass. The quantity of grass can be increased by fertilizing. Proper grazing and controlling wildfires and brush improve the quality and amount of forage.

This soil has low potential for most urban uses because of flooding. Limitations for lawns, golf fairways, picnic areas, and playgrounds are insignificant.

This Choska soil is in capability class I and in the Loamy Bottomland range site.

9—Choteau loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and moderately well drained. It is on slightly convex foot slopes of uplands or terraces. Individual areas are mostly 10 to 200 acres, but some areas are smaller.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsurface layer, to a depth of about 24 inches, is grayish brown loam. The subsoil extends to a depth of at least 62 inches. To a depth of about 36 inches it is yellowish brown silty clay loam, and to a depth of 46 inches, it is mottled gray, yellowish brown, yellowish red, and grayish brown clay loam. Below that, the subsoil is coarsely mottled yellowish brown, gray, yellowish red, and grayish brown clay loam.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. Permeability is slow, and the available water capacity in the upper 40 inches is high. This soil has good tilth and can be worked throughout a wide range of moisture content. A perched high water table is between depths of 2 and 3 feet during the winter and spring.

Included with this soil in mapping are Dennis and Taloka soils. The Dennis soils are in higher areas than the Choteau soil and make up about 10 percent of the map unit. Taloka soils are in lower areas and make up about 5 percent. Areas of these soils are generally less than 3 acres.

Choteau soil is used mostly for cultivated crops, such as soybeans, small grains, and sorghum. In a few areas, it is used for native grasses. In other areas, it is used for recreational activities and as habitat for wildlife.

This soil has high potential for cultivated crops. The main concerns in management are maintaining fertility and soil tilth and controlling loss of soil through erosion. Cropping systems need to provide for the return of adequate amounts of residue to the soil. Erosion can be reduced by contour farming, terracing, and managing crop residue. Vegetative cover is needed during winter and spring to help keep the soil from eroding. Fertilizer

increases plant growth and provides additional crop residue for erosion control. Terraces, contour tillage, and cover crops are especially needed if row crops are grown.

This Choteau soil has high potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has low potential for most urban uses. The permeability of the subsoil limits the use of this soil for septic tank absorption fields. High shrink-swell potential is the main limitation for dwellings, small commercial buildings, and local roads and streets.

This Choteau soil is in capability subclass IIe and in the Loamy Prairie range site.

10—Coweta fine sandy loam, 5 to 12 percent slopes. This soil is shallow, moderately sloping or strongly sloping, and well drained and somewhat excessively drained. It is on narrow ridge crests and short side slopes on uplands. Most areas are 40 to 200 acres, but some areas are 10 acres.

Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is brown fine sandy loam to a depth of about 16 inches. The underlying material is soft, fractured sandstone that extends to a depth of about 20 inches.

This soil is medium in natural fertility, and the organic matter content is moderate or moderately high. The soil is slightly acid or medium acid. Lime and plant food are needed for most pasture plants. Permeability is moderate, and the available water capacity is moderate.

Included with this soil in mapping are Bates soils and soils similar to the Coweta soil except the sandstone is hard. The included soils make up about 10 percent of the map unit, but areas of these soils are less than 3 acres.

This Coweta soil is used mostly for tame pasture and native grasses. In other areas, it is used for recreational activities and as habitat for wildlife.

This soil has low potential for cultivated crops. The main concerns in management are depth to sandstone or shale, droughtiness, and steepness of slope. This soil is generally not suitable for cultivation.

The Coweta soil has medium potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizing in tame pasture improves the quality of grass and increases the amount of forage. The additional plant growth protects the soil from erosion.

This soil has low potential for most urban uses (fig. 2). Depth to bedrock severely limits the use of this soil for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, dwellings, small commercial buildings, and local roads and streets.

This Coweta soil is in capability subclass VIe and in the Shallow Prairie range site.

11—Cupco silt loam, occasionally flooded. This soil is deep, nearly level, and somewhat poorly drained. It is on smooth flood plains. Most areas are 25 to 125 acres, but some areas are about 10 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer, to a depth of about 14 inches, is dark brown silt loam. The subsoil to a depth of about 45 inches is dark grayish brown silty clay loam, and to a depth of about 75 inches, it is light brownish gray silty clay loam.

This soil is medium in natural fertility, and the organic matter content is very low to moderate. The surface layer is medium acid to very strongly acid. Lime and plant food are needed for most crops. Permeability is moderately slow, and the available water capacity is high to very high. This soil has good tilth and can be worked throughout a wide range of moisture content. A perched high water table is at a depth of 0.5 foot to 2.0 feet during winter and spring.

Included with this soil in mapping are a few small intermingled areas of Verdigris soils. Also included in concave areas are soils similar to the Cupco soil except they are more wet and the profile does not include chroma of 3 or more. The included soils make up about 20 percent of the map unit, but areas of these soils are less than 3 acres.

This Cupco soil is used mainly for tame pasture. The main field crops are wheat, grain sorghum, and soybeans. In few areas, this soil is used as woodland.

This soil has a medium potential for cultivated crops. The main concerns in management are flooding, surface wetness, slow water intake, and soil tilth. Close-grown crops are needed late in fall and in winter and spring to prevent excessive loss of soil during flooding. The planting of spring crops needs to be delayed until after the common flood periods. Most crops can be grown continuously if the soil has been fertilized for maximum crop residue. Large amounts of residue help maintain organic matter and contribute to good soil tilth and intake of water. If this soil is wet, tillage or grazing breaks down soil structure and reduces water intake. A drainage system that includes row arrangement for drainage reduces surface wetness and allows for better crop growth.

This soil has medium potential for native grasses and high potential for tame pasture. Bermudagrass or tall fescue and clover is the most commonly used tame pasture. Fertilizing in tame pasture improves the quality and quantity of forage; the additional plant growth protects the soil from water erosion. All grasses can be improved by controlling grazing, proper stocking, and preventing wildfires.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable

species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. Wetness and flooding limit the use of this soil for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, and dwellings.

This Cupco soil is in capability subclass IIIw and in the Loamy Bottomland range site.

12—Dennis silt loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and moderately well drained. It is on uplands. Individual areas are mostly 50 to 350 acres, but some areas are about 15 acres.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil extends to a depth of about 65 inches. It is brown silty clay loam to a depth of about 24 inches, brown and light olive brown clay to a depth of about 55 inches, and coarsely mottled yellowish brown and gray clay below that.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer of this soil is slightly acid where lime has been added, but the Dennis soil is generally medium acid or strongly acid, and it requires lime for most crops. Plant food is also needed for most crops. Permeability is slow and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. A perched high water table is between depths of 2 and 3 feet during the winter and spring.

Included with this soil in mapping are intermingled areas of Taloka, Woodson, Okemah, and Bates soils. The included soils make up about 14 percent of the map unit, but areas of these soils are less than 3 acres.

This Dennis soil is used mostly for grain sorghums, soybeans, and wheat (fig. 3). In other areas, it is used for recreational activities, as habitat for wildlife, or for urban development.

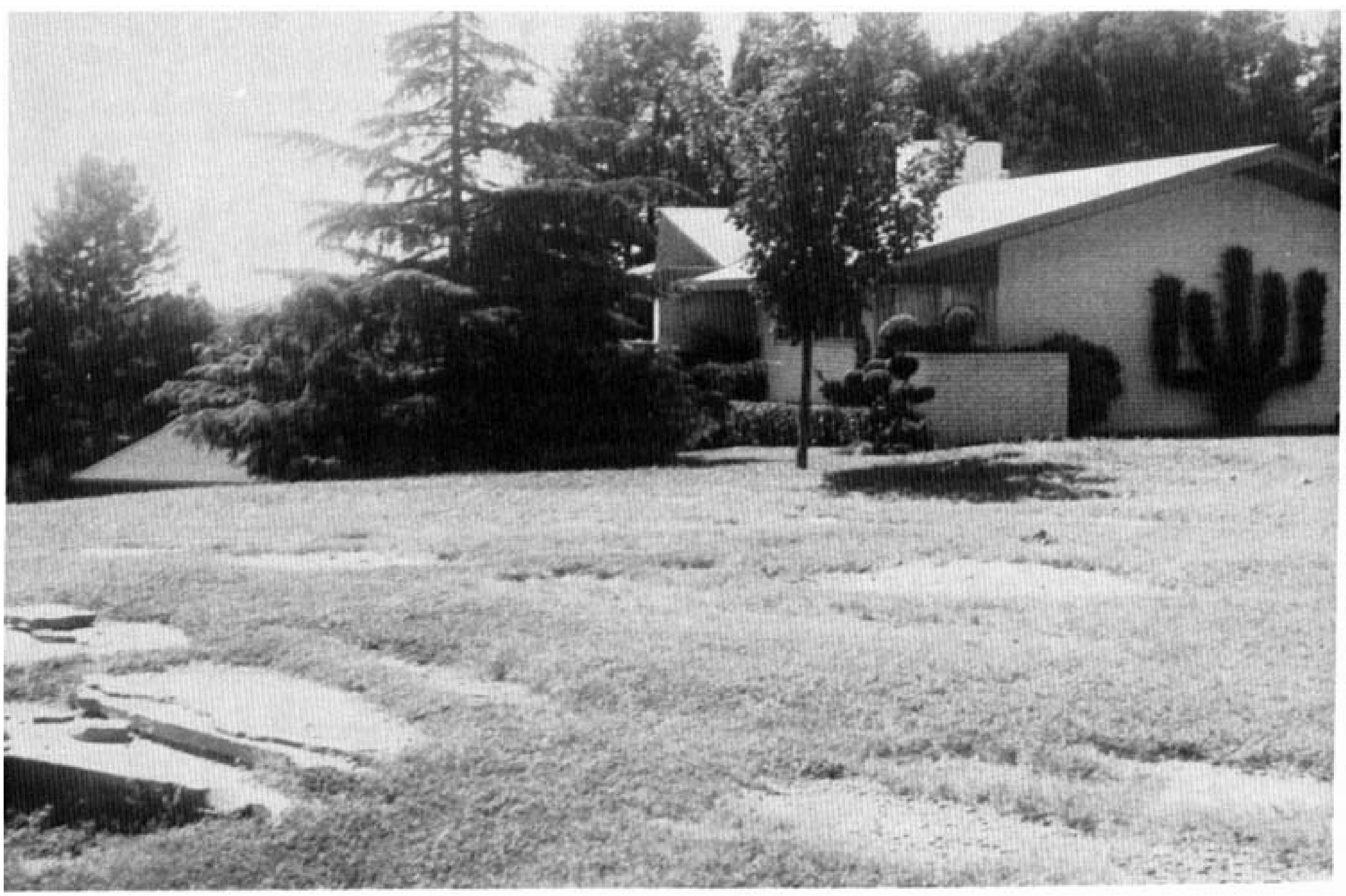


Figure 2.—Coweta fine sandy loam, 5 to 12 percent slopes, is poorly suited to use as sites for dwellings because of the shallow depth to bedrock. It also has severe limitations for lawns and landscaping.

Figure 3.—Wheat grows well on Dennis silt loam, 1 to 3 percent slopes.

This soil has high potential for cultivated crops. Soil management is needed to maintain fertility and tilth and to control loss of soil through erosion. Cropping systems need to provide for the return of adequate amounts of residue to the soil. Erosion can be reduced by contour farming, terracing, and managing crop residue. Vegetative cover is needed during winter and spring to help keep the soil from eroding. Fertilizer increases plant growth, and the increased growth provides additional crop residue for erosion control. Terraces, contour tillage, and cover crops are especially needed where row crops are grown. Excessive tillage needs to be avoided.

The Dennis soil has high potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has low potential for most urban uses. Because of the high shrink-swell potential and low strength, this soil has limitations for dwellings, commercial buildings, and roads and streets. The clayey subsoil is the main limitation for septic tank filter fields, and trench-type sanitary landfills. This soil has high corrosivity for uncoated steel pipe.

This Dennis soil is in capability subclass IIe and in the Loamy Prairie range site.

13—Dennis silt loam, 3 to 5 percent slopes. This soil is deep, moderately well drained, and gently sloping. It is on side slopes of uplands. Slopes are smooth and

slightly convex. Individual areas are mostly 25 to 200 acres, but some areas are about 5 acres.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil extends to a depth of at least 72 inches. It is brown silt loam to a depth of about 20 inches and yellowish brown clay below that.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is medium acid or strongly acid. Permeability is slow, and the available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and fairly easily penetrated by plant roots. A perched high water table is between depths of 2 and 3 feet during the winter and spring.

Included with this soil in mapping are a few intermingled areas of Bates and Taloka soils. The included soils make up about 10 to 15 percent of this map unit, but individual areas of these soils generally are less than 3 acres.

This Dennis soil is used mainly as pasture and hayland, although in some areas it is used for cultivated crops. In other areas, this soil is used for native grasses.

This soil has medium potential for row crops and small grains. Good tilth can be maintained by returning crop residue to the soil. Erosion is a moderate hazard if cultivated crops are grown. Conservation tillage, contour tillage, terraces, and cover crops in the cropping system slow runoff and help control erosion.

This soil has high potential for native grasses and tame pasture. Fertilizing tame pastures increases the amount of forage that helps protect the soil from erosion. All forage can be improved by controlling grazing, preventing wildfires, and controlling weeds.

This soil has low potential for most urban uses. The shrink-swell potential and low strength are limitations that can be overcome by good design and careful installation procedures for buildings, roads, and streets. The clayey subsoil has slow permeability, which is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This Dennis soil is in capability subclass IIIe and in the Loamy Prairie range site.

14—Dennis silt loam, 2 to 5 percent slopes, eroded. This soil is deep, moderately well drained, and very gently sloping or gently sloping. It is on eroded side slopes on uplands. Slopes are smooth and slightly convex. In about 40 percent of the area, the surface layer has been thinned by erosion and material from the upper part of the subsoil has been mixed by plowing. Shallow rills are common, and a few crossable gullies are 300 to 600 feet apart over much of the area. Individual areas are mostly 15 to 45 acres, but there are smaller areas.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of at least 73 inches. It is dark brown silt loam to a depth of 14 inches and yellowish brown clay loam to a depth of about 26 inches. To a depth of about 40 inches, the subsoil is strong brown silty clay that has mottles. Below that, it is silty clay that is coarsely mottled in shades of brown and gray.

This soil is moderate in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is medium acid or strongly acid. Permeability is slow, and the available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by plant roots. A perched high water table is between depths of 2 and 3 feet during the winter and spring.

Included with this soil in mapping are a few intermingled areas of Bates, Parsons, and Taloka soils. Bates soils are on higher slopes than the Dennis soil, and Parsons and Taloka soils are on lower convex side slopes. The included soils make up about 10 percent of this map unit, but individual areas of these soils generally are less than 3 acres.

This Dennis soil is used mainly as pasture and hayland. In some areas, it is used for cultivated crops.

This soil has medium potential for row crops and small grains, but high yields can be obtained. Potential is limited because of slope and susceptibility to erosion. Good tilth can be maintained by returning crop residue to the soil. Erosion is a severe hazard if cultivated crops are grown. Terraces, contour tillage, conservation tillage, and cover crops slow runoff and help control erosion. To prevent excessive erosion, row crops in the cropping system need to be kept to a minimum.

This soil has high potential for native grasses and medium potential for tame pasture. Cultivated areas need to be returned to tame pasture or native grasses. Fertilizing, diverting upslope water, and shaping small gully banks are needed to help establish tame pasture plants. The quality and quantity of all forage can be improved by proper grazing, controlling weeds and brush, and preventing wildfires.

This soil has low potential for most urban uses. The shrink-swell potential and low strength are limitations that can be overcome by good design and careful installation procedures for buildings and roads and streets. The clayey subsoil has slow permeability, which is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This Dennis soil is in capability subclass IIIe and in the Loamy Prairie range site.

15—Dennis silt loam, 2 to 6 percent slopes, gullied. This soil is deep, moderately well drained, and very gently sloping to moderately sloping. It is on severely

eroded side slopes of uplands. Slopes are smooth and convex. Individual areas are 5 to 15 acres.

Gullies caused by water erosion are common over most of the area. They range from 1 to 5 feet in depth and from 4 to 10 feet in width and are from 200 to 400 feet apart. Between gullies, in about 50 percent of the area, the surface layer has been removed by erosion. In about 20 percent of the area, the surface layer and the upper part of the subsoil have been mixed by cultivation.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of at least 62 inches. It is very dark grayish brown clay loam to a depth of 10 inches, and it is coarsely mottled dark yellowish brown, gray, and yellowish red clay below that.

This soil is low in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is medium acid or strongly acid. Permeability is slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and fairly easily penetrated by plant roots. A perched high water table is between depths of 2 and 3 feet during the winter and spring.

Included with this soil in mapping are a few intermingled areas of Bates, Parsons, and Taloka soils. Bates soils are on higher slopes than the Dennis soil, and Parsons and Taloka soils are on lower convex side slopes. The included soils make up about 10 to 15 percent of this map unit, but individual areas of the soils are mostly less than 3 acres.

This Dennis soil is used mainly as pasture and hayland.

This soil has low potential for row crops and small grains and is best suited to other uses, such as pasture. Potential is limited because of the susceptibility to erosion, gullies, and slopes. Erosion is a severe hazard if this soil is plowed.

This soil has high potential for native grasses and medium potential for tame pasture. Cultivated areas need to be returned to tame pasture or native grasses. Fertilizing, diverting upslope water, and shaping gully banks are needed to help establish tame pasture plants. The quality and quantity of all forage can be improved by proper grazing, controlling weeds and brush, and preventing wildfires.

This soil has low potential for most urban uses because of the severe hazard of erosion. In some areas, gullies need to be filled and reshaped. The shrink-swell potential and low strength are limitations that can be overcome by good design and careful installation procedures for buildings and roads and streets. The clayey subsoil has slow permeability, which is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This Dennis soil is in capability subclass VIe and in the Eroded Prairie range site.

16—Dennis-Urban land complex, 0 to 3 percent slopes. This complex is on uplands. It is made up of areas of Dennis soil and Urban land that are too intricately mixed or too small to conform to the scale used for the maps in the back of this publication. The Dennis soil is nearly level or very gently sloping and moderately well drained. Individual areas of this map unit range from 20 to 80 acres and contain about 40 percent Dennis soil and about 30 percent Urban land.

This Dennis soil has a surface layer of very dark grayish brown silt loam about 15 inches thick. The subsoil extends to a depth of at least 62 inches. It is brown, yellowish red, strong brown, and yellowish brown silty clay loam to a depth of 24 inches and light olive brown and gray clay to a depth of 55 inches. Below that, it is yellowish brown clay that has coarse mottles in shades of red and gray.

Permeability is moderately slow or slow. Reaction is medium acid or strongly acid in the surface layer and very strongly acid to moderately alkaline in the subsoil. Shrink-swell potential is high below a depth of 20 inches. In areas that are not drained, a perched high water table is at a depth of 2 to 3 feet during winter and spring.

The urban land part of the complex is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible. The urban areas of this complex are artificially drained through sewer systems, gutters, drainage tiles, and to lesser extent, surface ditches.

In about 20 percent of this map unit, the soils have been modified by excavating, filling, and grading. In excavated areas, the surface layer is clayey. The fill is generally loamy material that has been hauled in from other areas.

Included in mapping are small areas of Parsons, Taloka, and Stigler soils. The Parsons and Taloka soils are somewhat poorly drained and are in lower convex areas on the landscape than the Dennis soil. The Stigler soils are moderately well drained and are in higher, better drained positions similar to those of the Dennis soil. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 3 acres.

The soils in this complex are used mostly for urban development including parks, lawns, gardens, and industry.

The Dennis soil is well suited to grasses, flowers, vegetables, trees, and shrubs. Soil erosion is generally not a problem unless the soil is disturbed and left in a bare, exposed condition for a considerable period of time, or if the soil is used as a water course.

The main concerns in management of this soil for urban development is the slow permeability, high shrink-swell potential, and the texture and acidity of the subsoil.

These limitations are severe for septic tank absorption fields, sanitary landfills, small commercial buildings, local roads and streets, and shallow excavations. The texture and acidity of the subsoil cause high corrosivity for uncoated steel and moderate corrosivity for concrete.

This complex was not assigned to a capability subclass or range site.

17—Dennis-Verdigris complex, 0 to 12 percent slopes. This complex is made up of Dennis and Verdigris soils that are moderately well drained. Dennis soil is slowly permeable, and Verdigris soil is moderately permeable. These soils are in a mixed pattern of 35 percent Dennis soil on very gently sloping to strongly sloping valley sides and 22 percent Verdigris soil along the valley flood plain of intermittent streams.

Typically, Dennis soil has a very dark grayish brown silt loam surface layer about 10 inches thick. The subsoil extends to a depth of at least 72 inches. To a depth of about 16 inches it is very dark grayish brown silty clay loam, and to a depth of about 36 inches it is yellowish brown clay. Below that, the subsoil is mottled yellowish brown and gray clay.

This soil is high in natural fertility. The organic matter content is moderate or moderately high. The surface layer is medium acid or strongly acid. This soil is more than 60 inches thick. The available water capacity in the upper 40 inches is high. Shrink-swell potential of the subsoil is high. A perched high water table is between depths of 2 and 3 feet during winter and spring.

Typically, Verdigris soil is very dark grayish brown silt loam to a depth of about 14 inches and very dark grayish brown silty clay loam to a depth of about 34 inches. The underlying material is dark gray silty clay loam to a depth of about 62 inches.

This soil is high in natural fertility, and the organic matter content is moderately high. Depth to bedrock is more than 60 inches. The available water capacity is high to very high. This soil is subject to frequent flooding (fig. 4).

Included with this complex in mapping are the Bates, Okemah, Stigler, and Taloka soils. Also included are small areas of soils similar to the Dennis soil except they have a thinner surface layer. These soils are on slopes of more than 8 percent. The included soils make up about 43 percent of the map unit.

The soils in this complex are used mostly as range and woodland. In a few areas, they are used for tame pasture.

The soils in this complex have low potential for crops and high potential for tame pasture and native grasses. The main concerns in management are the steepness of slopes and the hazard of flooding. The native grasses can be maintained or improved by controlling brush, using suitable grazing practices, and preventing wildfires. In tame pasture areas, fertilizer and proper grazing help to provide a grass-mulch cover, which protects the soils from erosion during floods.

Thinning, weeding, and selectively harvesting the hardwoods increase timber production in areas where these soils are used as woodland.

These soils have low potential for most urban uses. Slope, high shrink-swell potential, and slow permeability are the main limitations of the Dennis soil. Flooding is a hazard on the Verdigris soil.

The soils in this complex are in capability subclass VIe. The Dennis soil is in the Loamy Prairie range site, and the Verdigris soil is in the Loamy Bottomland range site.

18—Enders-Linker-Hector association, moderately steep. The Enders, Linker, and Hector soils are in a regular and repeating pattern on wooded uplands that have deeply entrenched drainageways. Slopes are dominantly 5 to 30 percent. The mapped areas range from 50 to 2,000 acres, but individual areas of each soil range from 5 to 40 acres.

The Enders and Linker soils are on moderately steep, convex side slopes in long, narrow, repeating patterns across the slope. Enders soil is deep and formed in material weathered from shale, and Linker soil is moderately deep and formed in material weathered from sandstone. The Hector soil is on convex ridges and side slopes between areas of the Enders soil. The Hector soil is shallow and formed in material weathered from hard sandstone.

Enders soil makes up 35 to 55 percent of this association. Typically, the surface layer is about 6 inches thick. It is very dark brown loam to a depth of 3 inches and strong brown loam below that. The subsoil is clay. It extends to a depth of about 58 inches. It is red to a depth of about 26 inches and is mottled red, reddish brown, and weak red below that. The underlying material is gray shale to a depth of at least 72 inches.

The Enders soil is medium in natural fertility and low in organic matter content. The surface layer is strongly acid or very strongly acid except where lime has been added. Permeability is very slow, and the available water capacity is moderate to high. The root zone is deep.

Linker soil makes up about 20 to 30 percent of this association. Typically, the surface layer is dark grayish brown fine sandy loam about 3 inches thick and is grayish brown fine sandy loam to a depth of 6 inches. The subsoil extends to a depth of about 36 inches. It is strong brown fine sandy loam to a depth of about 10 inches and yellowish red sandy clay loam to a depth of about 22 inches. Below that, the subsoil is yellowish red sandy clay loam. The underlying material is sandstone bedrock.

The Linker soil is medium in natural fertility, and the organic matter content is low to moderately high. Reaction of the surface layer is slightly acid to strongly

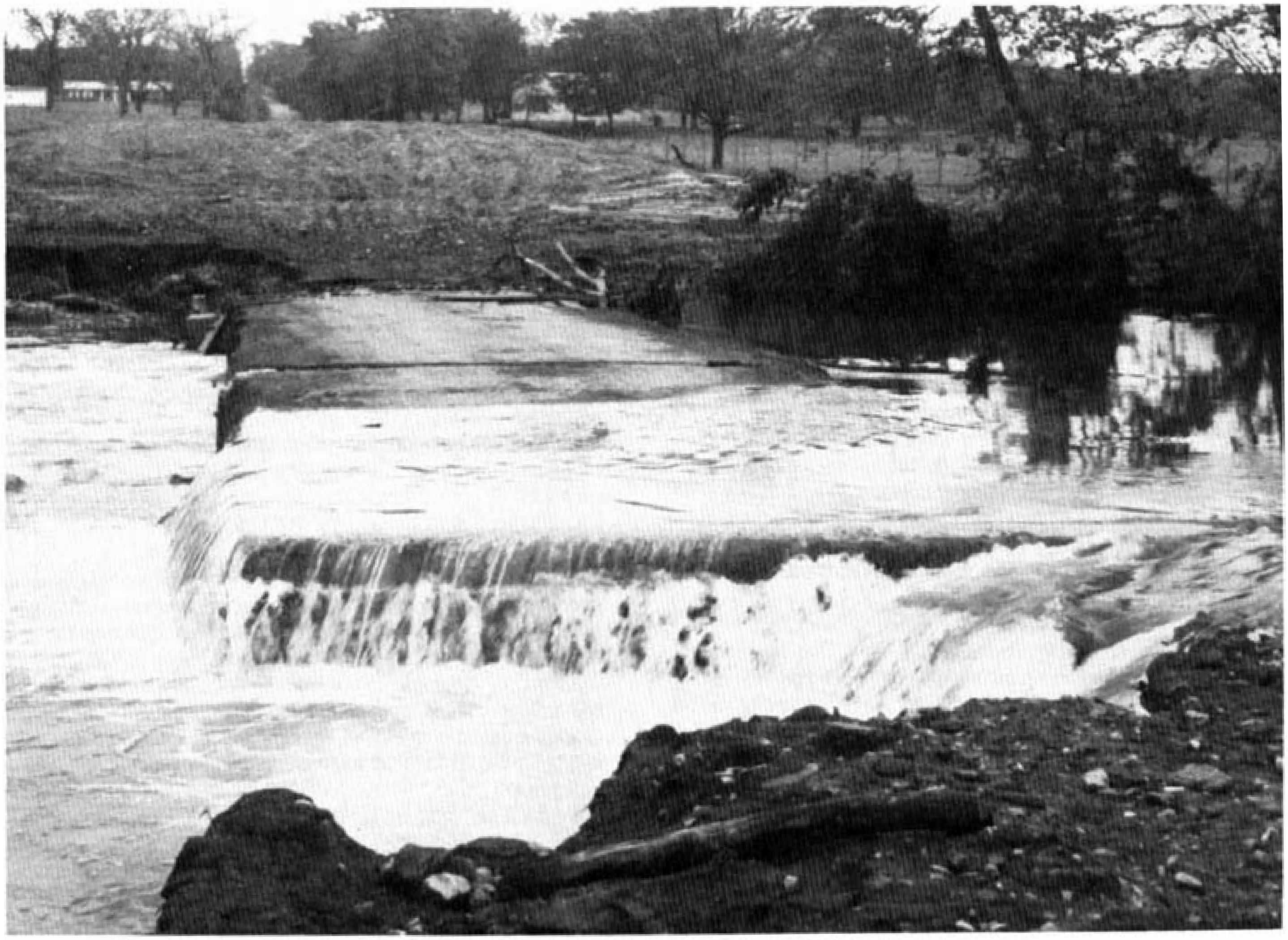


Figure 4.—The Verdigris soil in this area of Dennis-Verdigris complex, 0 to 12 percent slopes, is subject to frequent flooding.

acid. Permeability is moderate, and the available water capacity is moderate to high. The root zone is deep.

Hector soil makes up about 15 to 25 percent of this association. Typically, the surface layer is brown fine sandy loam about 3 inches thick. The subsurface layer, to a depth of about 6 inches, is brown fine sandy loam. The subsoil is strong brown fine sandy loam to a depth of about 16 inches. The underlying material is hard sandstone.

The Hector soil is low in natural fertility and in organic matter content. Reaction of the surface layer is slightly acid to strongly acid. Permeability is moderately rapid, and the available water capacity is low to moderate. The root zone is shallow.

Included with these soils in mapping are intermingled areas of Endsaw, Eram, Linker, and Oktaha soils. The included soils make up about 10 to 20 percent of this association, but areas of these soils are generally less than 10 acres.

The soils in this association are mainly used for native grasses. They also support small stands of hardwoods.

These soils have low potential for row crops and small grains. These soils are limited by the shallow depth, slope, and a severe hazard of erosion.

These soils have medium potential for native grasses and low potential for tame pasture. In some small areas within the delineation of this association, the soils can be seeded to tame pasture. The quality and quantity of forage can be improved by controlling woody plants, controlling grazing, and preventing wildfires.

These soils have low potential for most urban uses because of slope, soil depth, high shrink-swell potential,

and very slow permeability of the Enders soil. These limitations for sewage lagoons, sanitary landfills, and septic tank absorption fields can be overcome by proper structural design or by altering the soil.

The Enders, Linker, and Hector soils are in capability subclass VIIe. The Enders soil is in the Loamy Savannah range site, the Linker soil is in the Sandy Savannah range site, and the Hector soil is in the Shallow Savannah range site.

19—Endsaw-Hector association, steep. The Endsaw and Hector soils are in a regular and repeating pattern on wooded uplands that have deeply entrenched drainageways. Slopes are dominantly 15 to 50 percent. The mapped areas range from 50 to 1,500 acres, but individual areas of each soil range from 5 to 40 acres.

The Ensaw soil is on moderately steep to steep, convex side slopes in a long, narrow, repeating pattern across the slope. This soil is deep and formed in material weathered from shale. The Hector soil is on convex ridges and on side slopes between areas of the Endsaw soil. It is shallow and formed in material weathered from hard sandstone.

Endsaw soil makes up about 60 to 80 percent of the map unit. Typically, the surface layer is dark grayish brown stony fine sandy loam about 4 inches thick. The subsurface layer is brown stony fine sandy loam to a depth of about 9 inches. The subsoil is clay. It extends to a depth of about 42 inches. The subsoil is yellowish red to a depth of about 32 inches and mottled yellowish and gray below that. The underlying material is olive gray and gray soft shale.

This soil is low in natural fertility and organic matter content. Reaction of the surface layer is strongly acid or medium acid. Permeability is slow, and the available water capacity is low to high. The root zone is moderately deep.

Hector soil makes up about 15 to 25 percent of the map unit. Typically, the surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsurface layer is grayish brown stony fine sandy loam to a depth of about 9 inches. The subsoil is yellowish brown loam to a depth of about 15 inches. The underlying material is hard sandstone.

This soil is low in natural fertility and organic matter content. Reaction is slightly acid to strongly acid in the surface layer. Permeability is moderately rapid, and the available water capacity is low to moderate. The root zone is shallow.

Included with these soils in mapping are intermingled areas of Enders, Eram, Linker, and Oktaha soils. Sandstone outcrop makes up to 5 to 10 percent of the map unit. The included soils make up about 10 to 20 percent of the map unit, but areas of these soils are generally less than 20 acres.

The soils in this association are mainly used for native range. They also support small stands of hardwoods.

These soils have low potential for row crops and small grains because of large stones, rock outcrops, steep slopes, and shallow depth to bedrock. These limitations are very difficult to overcome.

The potential is medium for native grasses and tame pasture. In a few small areas within the delineation of this association, the soils can be seeded to tame pasture. The quality and quantity of forage can be improved by controlling woody plants, controlling grazing, and preventing wildfires.

These soils have low potential for most urban uses. Slope, soil depth, high shrink-swell potential, and the stony surface layer of these soils are the main limitations for sewage lagoons, sanitary landfills, and septic tank absorption fields. Some of these limitations can be overcome by proper structural design or by altering the soil.

These Endsaw and Hector soils are in capability subclass VIIs and in the Savannah Breaks range site.

20—Eram-Coweta-Rock outcrop association, strongly sloping. This association is made up of the moderately well drained Eram soil, the well drained to somewhat excessively drained Coweta soil, and Rock outcrop (fig. 5). These soils and Rock outcrop are on ridge crests and side slopes of uplands in a regular and repeating pattern. This association is about 45 percent Eram soils on side slopes, 20 percent Coweta soils on ridge crests, and about 15 percent Rock outcrop.

Typically, Eram soil has a surface layer of very dark grayish brown silt loam about 10 inches thick. The subsoil is clay. It extends to a depth of 30 inches. It is dark grayish brown to a depth of 14 inches and olive brown below that. The underlying material is olive gray, rippable shale.

Eram soil has a perched high water table between depths of 2 and 3 feet during the winter and spring. Permeability is slow, and the available water capacity between depths of 10 and 30 inches is high to very high.

Typically, Coweta soil has a surface layer of dark brown fine sandy loam about 7 inches thick. The subsoil is brown fine sandy loam to a depth of 13 inches. The underlying material is soft, rippable sandstone.

This soil is moderately permeable, and the available water capacity to a depth of 13 inches is moderate.

The Rock outcrop is bare areas of sandstone or areas that have a few inches of fine sandy loam over hard sandstone.

Included with these soils in mapping are intermingled areas of Bates, Enders, and Hector soils. The included soils make up about 20 percent of this map unit, but areas of these soils are generally less than 10 acres.

The soils in this association are mainly used for native grasses. In a few areas, they are used for tame pasture plants.

These soils have low potential for cultivation and for tame pasture and medium potential for native grasses.

Figure 5.—Eram-Coweta-Rock outcrop association, strongly sloping, is on ridges and side slopes. This soil is poorly suited to most uses.

The main concerns in management are depth to sandstone or shale, droughtiness, and steepness of slope. Quality of native grasses can generally be improved by proper grazing, controlling weeds, and protecting from wildfires. Fertilizing tame pastures increases the amount of forage and improves the quality of grass. The increased growth provides the soil with additional protection from erosion.

These soils have low potential for most urban use. Depth to bedrock is a limitation for sanitary facilities and building sites. This limitation is difficult to overcome.

The Eram and Coweta soils are in capability subclass VIe. Rock outcrop is in capability subclass VIIIs. The Eram soil is in the Loamy Prairie range site, the Coweta soil is in the Shallow Prairie range site, and Rock outcrop is not assigned to a range site.

21—Garton silt loam, rarely flooded. This soil is deep, nearly level, and moderately well drained. It occurs on flood plains that are plane to slightly concave. Individual areas are mostly 40 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown silt loam 11 inches thick. The subsoil is silty clay loam to a depth of at least 70 inches. It is dark brown to a depth of about 55 inches and reddish brown below that.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is medium acid to neutral. Lime and plant food are needed for some crops. Permeability is slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. A perched high water table is between depths of 2 and 3 feet during the winter and spring.

Included with this soil in mapping are intermingled areas of soil similar to the Garton soil except the subsoil is less clayey in the lower part. The included soils make up about 10 percent of the map unit, but areas of these soils are less than 5 acres.

This Garton soil is used mostly for alfalfa, corn, grain sorghum, soybeans, wheat, and vegetable crops (fig. 6). In a few areas, it is used for tame pasture plants, recreational activities, woodland, or habitat for wildlife.

This soil has high potential for cultivated crops. Management is needed to maintain soil tilth and fertility. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and most of the crop residue is returned to the soil. Fertilizer helps to maintain organic matter content, good structure, and fertility. Conservation tillage needs to be used.

The Garton soil has high potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using

suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. The clayey subsoil, wetness, and shrinking and swelling are the main limitations for septic tank absorption fields, sanitary landfills, shallow excavations, dwellings, small commercial buildings, and local roads and streets. Flooding is a hazard on building sites.

This soil is in capability class I and in the Loamy Bottomland range site.

22—Glenpool fine sand, 0 to 3 percent slopes. This soil is deep, somewhat excessively drained, and nearly level or very gently sloping. It is on broad, smooth stream terraces. Slopes are slightly undulating. Individual areas are mostly 20 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is brown fine sand about 6 inches thick. The subsurface layer, to a depth of about 52 inches, is strong brown fine sand. The subsoil extends to a depth of about 99 inches. To a depth of about 76 inches, it is reddish yellow loamy fine sand that has thin lamellae of fine sandy loam. Below that, it is reddish yellow loamy fine sand that has discontinuous thin bands of yellowish red fine sandy loam.

This soil is low in organic matter content and natural fertility. The surface layer is strongly acid to slightly acid. Lime and plant food are needed for most crops. Permeability is rapid, and the available water capacity is low. This soil has good tilth and can be worked throughout a wide range of moisture content.

Figure 6.—Garton silt loam, rarely flooded, is well suited to use for such crops as soybeans.

Included with this soil in mapping are intermingled areas of Larton and Kamie soils. The included soils make up about 10 percent of the map unit, but areas of these soils are less than 5 acres.

This Glenpool soil is used mostly for grain sorghum, tame pasture plants, range plants, or as woodland. In some areas, it is used for urban development.

This soil has low potential for cultivated crops. The main concerns in management are maintaining soil fertility and controlling erosion. Most crops that produce large amounts of plant residue can be grown continuously if the residue is returned to the soil. Stripcropping and planting winter cover crops protect the soil from blowing. Fertilizer increases plant growth and provides more crop residue to control the loss of soil. Row crops should be kept to a minimum. Conservation tillage needs to be used.

The Glenpool soil has medium potential for native grasses and tame pasture. The quality and quantity of forage can be maintained and improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has high potential for trees. It produces high quality hardwoods if the trees are thinned, weeded, and selectively harvested.

This soil has high potential for most urban uses. It has no significant limitation for building site development. The rapid permeability limits use of this soil for sewage lagoons and sanitary landfill areas.

This Glenpool soil is in capability subclass IVs and in the Deep Sand Savannah range site.

23—Glenpool fine sand, 3 to 12 percent slopes. This soil is deep, gently sloping to strongly sloping, and somewhat excessively drained. It is on broad stream terraces. Slopes are smooth and slightly convex. Individual areas are mostly 25 to 150 acres, but some areas are smaller.

Typically, the surface layer is dark brown fine sand about 10 inches thick. The subsurface layer, to a depth of about 55 inches, is brown fine sand. The subsoil extends to a depth of about 99 inches. It is brown loamy fine sand that has thin lamellae of yellowish red fine sandy loam.

This soil is low in organic matter content and natural fertility. It is strongly acid to slightly acid. Lime and plant food are needed for most crops. Permeability is rapid, and the available water capacity is low. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are the Larton and Kamie soils in intermingled areas. The included soils make up about 10 percent of the map unit, but most areas of these soils are generally less than 5 acres.

This Glenpool soil is used mostly for range plants or as woodland. In a few areas, it is used for tame pasture plants, recreational activities, or as habitat for wildlife.

This soil has low potential for cultivated crops. Erosion is a severe hazard that makes it generally unsuitable for cultivation.

This soil has medium potential for native grasses and tame pasture. Fertilizing tame pasture increases forage production, and the increased growth protects the soil from erosion. Controlling grazing, preventing wildfires, and controlling brush are the main concerns in management.

This soil has medium potential for most urban uses. Modification of the slopes of more than 8 percent or special structural design on this soil is needed for dwellings, commercial buildings, and roads and streets. Seepage is the main limitation of this soil for sewage lagoons or sanitary facilities. Good structural design to compensate for soil acidity is needed for concrete pipe.

This Glenpool soil is in capability subclass VIe and in the Deep Sand Savannah range site.

24—Kamie fine sandy loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and well drained. It is on broad, smooth, slightly convex stream terraces. Individual areas are mostly 25 to 250 acres, but some areas are about 15 acres.

Typically the surface layer is dark brown fine sandy loam about 7 inches thick. The subsurface layer to a depth of about 12 inches is brown fine sandy loam. The subsoil is sandy clay loam. It extends to a depth of about 66 inches. It is red to a depth of about 48 inches and light red below that.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is moderate to high. The soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Glenpool and Larton soils. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Kamie soil is used mainly as cropland or pasture. Soybeans, grain sorghums, and wheat are the main cultivated crops. Bermudagrass is the principle pasture grass. Small areas are forested with oak, elm, and hickory and have an understory of grass.

This soil has high potential for cultivated crops. The main concerns in management are controlling soil erosion and maintaining soil fertility. Terraces are needed where the soil is eroding. Fertilizer increases plant growth and provides more crop residue to help maintain soil tilth, fertility, and intake of water. Contour farming, stripcropping, and returning crop residue to the soil help control erosion. Winter cover crops following

row crops furnish additional soil protection against wind and water action.

This soil has medium potential for native grasses and high potential for tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using proper grazing practices, and protecting from wildfires. Fertilizer also increases the quantity and quality of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has high potential for most urban uses. Limitations for dwellings and small commercial buildings are insignificant. Low strength is the main limitation for roads and streets. The size of the septic tank absorption field may need to be increased slightly for the best sewage disposal.

This Kamie soil is in capability subclass IIe and in the Sandy Savannah range site.

25—Kamie fine sandy loam, 3 to 5 percent slopes. This soil is deep, gently sloping, and well drained. It is on broad, smooth, convex stream terraces. Individual areas are mostly 25 to 250 acres, but some areas are about 15 acres.

Typically the surface layer is brown fine sandy loam about 7 inches thick. The subsurface layer, to a depth of about 11 inches, is brown fine sandy loam. The subsoil extends to a depth of about 65 inches. It is red sandy clay loam and clay loam to a depth of about 50 inches and red fine sandy loam below that.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is moderate to high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Glenpool and Larton soils. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Kamie soil is used mainly as cropland or pasture. Cultivated crops are mainly soybeans, grain sorghums, and wheat. Bermudagrass is the principle pasture grass. Some small areas are forested with oak, elm, or hickory and have a grass understory.

This soil has medium potential for cultivated crops. The main concerns in management are maintaining soil fertility and controlling erosion. Row crops should be planted on the contour in alternate strips with sown crops. Terraces and contour tillage are not needed if close-growing, soil-improving crops are grown every year. Adequate crop residue should be utilized to protect the soil. Cover crops help to control erosion during the spring.

This soil has medium potential for range and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using proper grazing practices, and protecting from wildfires. Fertilizer also increases the quality and quantity of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has high potential for most urban uses. Limitations for dwellings are insignificant. Slope needs to be considered in constructing small commercial buildings. Low strength is the main limitation for roads and streets. Septic tank absorption fields need to be increased slightly because of moderate permeability.

This Kamie soil is in capability subclass IIIe and in the Sandy Savannah range site.

26—Kamie fine sandy loam, 2 to 8 percent slopes, gullied. This soil is deep, very gently sloping to moderately sloping, and well drained. It is on broad, smooth, convex stream terraces. Individual areas are mostly 25 to 150 acres, but some areas are about 5 acres.

Gullies caused by water erosion range from 2 to 10 feet in depth and from 10 to 20 feet in width. They are from 200 to 400 feet apart. Between gullies, the surface layer has been removed by erosion in 50 percent of the area. In 20 percent of the area, the surface layer and the upper part of the subsoil have been mixed by past cultivation. In this area, the surface layer is fine sandy loam, loamy fine sand, and sandy clay loam.

Typically the surface layer is brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of about 64 inches. It is red sandy clay loam and clay loam to a depth of about 50 inches and red fine sandy loam below that.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is moderate to high.

Included with this soil in mapping are intermingled areas of soils similar to the Kamie soil, but one has a surface layer more than 20 inches thick and the other has a dark-color surface layer and more clayey subsoil. The included soils make up about 15 percent of this map unit, but areas of these soils are generally less than 5 acres.

This Kamie soil is used mostly as native range or woodland. It is not suited to cultivated crops because erosion is a severe hazard.

This soil has medium potential for tame pasture and low potential for native grasses. Proper grazing, controlling brush, and protecting the soil from wildfires contribute to better forage. Fertilizing and proper grazing

improve tame pasture plants, and the increase in plants helps control erosion. Weeding, thinning, and selectively cutting the woodland improve the quality of trees.

This soil has medium potential for most urban uses. Seepage and low strength are the main limitations for sewage lagoons and local roads and streets. This soil is well suited to trees, shrubs, flowers, lawn grasses, and many garden plants. In some areas, gullies should be shaped and filled.

This Kamie soil is in capability subclass VIe and in the Eroded Sandy Savannah range site.

27—Kanima shaly silty clay loam, 3 to 30 percent slopes. This soil is deep, gently sloping to steep, and well drained. It formed in spoil banks that remain after strip mine operations. The spoil banks are in a sequence of long and narrow ridges with convex crests 10 to 30 feet in width and side slopes of 20 to 50 feet in length. These parallel ridges range from 200 to 1,000 feet in width and up to 3 miles in length. Individual areas of this soil are from 50 to 250 acres.

Typically, the surface layer is dark grayish brown shaly silty clay loam about 4 inches thick. The underlying material is olive brown very shaly silty clay loam to a depth of about 72 inches.

This soil is low in natural fertility, and the organic matter content is low to moderate. The surface layer is medium acid to mildly alkaline. Lime and fertilizer are necessary for some plants. Permeability is moderate, and the available water capacity is low to moderate. Plant roots are restricted somewhat by the high amount of shale fragments.

Included with this soil in mapping are a few small areas of Bates, Choteau, Dennis, Parsons, Taloka, and Woodson soils. Barren areas of shale that have little or no soil material make up about 15 percent of the map unit and pits make up about 8 percent. The pits commonly are 50 to 400 feet wide, 500 to 1,000 feet long, and 15 to 75 feet deep. Most pits contain water that is generally within 10 to 20 feet of the surface.

This Kanima soil is used mostly as pasture and woodland. Most areas support lower quality grasses, shrubs, and trees. In other areas, this soil is used for recreational activities or as habitat for wildlife (fig. 7).

This soil has low potential for cultivated crops, native grasses, tame pasture, and urban uses because of the low available water capacity and the difficulty on the steep slopes in preparing a seedbed for tame pasture plants.

This Kanima soil is in capability subclass VIIs. It is not assigned to a range site.

28—Keo very fine sandy loam, rarely flooded. This soil is deep, well drained, and nearly level. It is on flood plains of the Arkansas River. Slopes are smooth and slightly convex and range from 0 to 1 percent. Individual areas are irregular in shape. They mostly range from 40 to 200 acres, but some areas are about 15 acres.

Typically, the surface layer is dark reddish brown very fine sandy loam about 9 inches thick. The subsoil is dark reddish brown silt loam to a depth of about 24 inches and reddish brown very sandy loam to a depth of about 41 inches. The underlying material is reddish brown very fine sandy loam to a depth of about 71 inches.

This soil is medium in natural fertility, and the organic matter content is low to moderate. Reaction is neutral or mildly alkaline in the surface layer. Permeability is moderate, and surface runoff is slow. The available water capacity is high. The surface layer is friable and easily tilled throughout a wide range of moisture content. Root development is unrestricted throughout the soil.

Included with this soil in mapping are small areas of Choska, Norwood, and Roxana soils. The included soils make up about 10 percent of the map unit, but areas of these soils are less than 3 acres.

This Keo soil has high potential for cultivated crops. All areas of this soil are cultivated. The soil is well suited to soybeans, wheat, corn, and grain sorghum. Erosion is a slight hazard, but conservation tillage and winter cover crops prevent soil loss from erosion. Returning a large amount of crop residue to the soil improves fertility and water infiltration and reduces crusting.

This soil has high potential for tame pasture, alfalfa, bermudagrass, and other grasses and legumes. The use of this soil as pastureland or hayland is effective in controlling erosion. Controlling brush, proper grazing, fertilizing, and preventing wildfires improve the quality and quantity of forage.

This soil has high potential for growing trees for windbreaks and environmental plantings.

This soil has medium potential for most urban uses because of flooding. Other limitations include moderate permeability for septic tank absorption fields and seepage for trench sanitary landfills and sewage lagoons.

This Keo soil is in capability class I and in the Loamy Bottomland range site.

29—Kiomatia loamy fine sand, frequently flooded. This soil is deep, well drained, and nearly level. It is on flood plains in areas mainly along the Arkansas and South Canadian Rivers. Slopes are slightly undulating and range from 0 to 1 percent. Individual areas are 20 to 200 acres.

Typically, the surface layer is brown loamy fine sand about 10 inches thick. The underlying material is to a depth of about 62 inches is brown loamy fine sand that has few thin strata of fine sandy loam and fine sand.

This soil is low in natural fertility and organic matter content. It is slightly acid to moderately alkaline in the surface layer. Permeability is rapid. The available water capacity is low to moderate; however, some plants obtain moisture from an apparent high water table at a

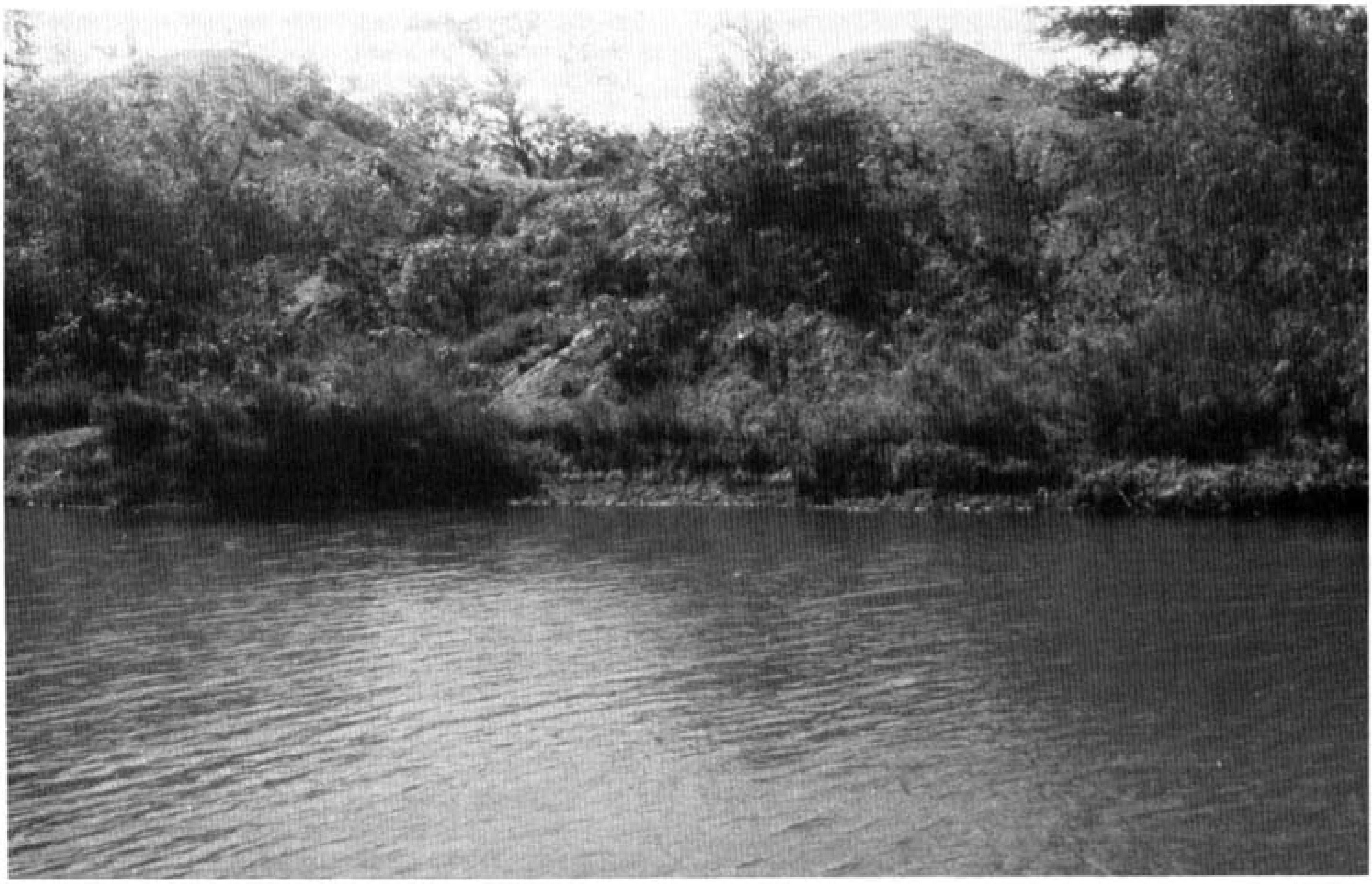


Figure 7.—A strip mine in an area of Kanima shaly silty clay loam, 3 to 30 percent slopes, is used as a pond reservoir.

depth of 3 to 5 feet during winter, spring, and summer. Flooding is a severe hazard.

Included with this soil in mapping are areas of Choska, Roxana, and Severn soils. These soils are in higher positions than the Kiomatia soil. Also included are a few intermingled areas of soils similar to the Kiomatia soil except the underlying material is grayer. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Kiomatia soil is used mainly as range. In some areas, it is used for tame pasture.

This soil has low potential for cultivated crops because of frequent flooding.

This soil has medium potential for tame pasture and native grasses. Bermudagrass in combination with clovers is most commonly used for tame pasture. Fertilizing tame pasture increases forage production and improves the quantity of grass. The increase in plants protects the soil from erosion. The quality and quantity of forage can be improved by controlling grazing, proper stocking, and preventing wildfires.

This soil has low potential for most urban uses because it is frequently flooded. Flooding can be reduced but not completely eliminated by upstream flood control structures.

This Kiomatia soil is in capability subclass Vw and in the Sandy Bottomland range site.

30—Kiomatia fine sandy loam, rarely flooded. This soil is deep, nearly level or very gently sloping, and well drained. It is on broad, slightly undulating flood plains. Slopes are 0 to 2 percent. Individual areas are generally 35 to 150 acres, but some areas are about 15 acres.

Typically, the surface layer is brown fine sandy loam about 16 inches thick. The underlying material to a depth of about 60 inches is reddish brown loamy fine sand and loamy sand that has thin strata of fine sandy loam.

This soil is low in natural fertility and organic matter content. It is slightly acid to moderately alkaline in the surface layer. Permeability is rapid. The available water capacity is low to moderate; however, some plants can obtain moisture from an apparent high water table at a

depth of 3 to 5 feet during winter, spring, and summer. This soil is rarely flooded.

Included with this soil in mapping are areas of Roxana and Severn soils. These soils are in higher positions than the Kiomatia soil. Also included are intermingled areas of soils similar to the Kiomatia soil, but they have a finer textured surface layer. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Kiomatia soil is used for wheat, grain sorghums, and tame pasture grasses.

This soil has medium potential for cultivated crops. Crop residue returned to the soil, fertilization, and conservation tillage maintain or improve soil structure and fertility and help control wind erosion. Erosion can also be reduced by stripcropping and control farming. Cover crops and control farming are especially needed if row crops are grown.

The Kiomatia soil has medium potential for tame pasture and native grasses. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer also increases growth of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. The main concerns in using this soil are flooding and seepage.

This Kiomatia soil is in capability subclass IIIs and in the Sandy Bottomland range site.

31—Kiomatia fine sandy loam, frequently flooded. This soil is deep, nearly level or very gently sloping, and well drained. It is on broad, slightly undulating flood plains. Slopes are 0 to 2 percent. Individual areas are generally 35 to 150 acres, but some areas are about 15 acres.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The underlying material to a depth of about 60 inches is brown loamy fine sand that has thin strata of fine sandy loam.

This soil is low in natural fertility and organic matter content. It is slightly acid to moderately alkaline in the surface layer. Permeability is rapid. The available water capacity is low to moderate, however, some plants can obtain moisture from an apparent high water table at a depth of 3 to 5 feet during winter, spring, and summer. This soil is frequently flooded.

Included with this soil in mapping are areas of Choska and Severn soils. These soils are in higher positions than the Kiomatia soil. Also included are intermingled areas of soils similar to the Kiomatia soil, except they have a finer textured surface layer. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Kiomatia soil is used mainly as native range. In a few areas, it is used for tame pasture plants.

This soil has low potential for cultivated crops because of flooding.

This Kiomatia soil has medium potential for tame pasture and native grasses. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer also increases growth of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. The main concerns in using this soil are flooding and seepage.

This Kiomatia soil is in capability subclass Vw and in the Sandy Bottomland range site.

32—Larton loamy fine sand, 0 to 3 percent slopes. This soil is deep, nearly level or very gently sloping, and well drained. It is on terraces. Individual areas are mostly 40 to 200 acres, but some areas are about 15 acres.

Typically the surface layer is brown loamy fine sand about 14 inches thick. The subsurface layer, to a depth of about 28 inches, is brown loamy fine sand. The subsoil extends to a depth of about 69 inches. It is yellowish red sandy clay to a depth of about 44 inches and yellowish red fine sandy loam below that.

Larton soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Lime and plant food are needed for some crops. The available water capacity in the upper 40 inches is low to moderate. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Glenpool and Kamie soils. The included soils make up about 10 percent of this map unit, but areas of these soils are generally less than 5 acres.

This Larton soil is used for grain sorghums, soybeans, wheat, and tame pasture plants. Some areas remain in woodland or native grasses.

This soil has medium potential for cultivated crops. Management is needed to control erosion and maintain soil fertility. Most crops that product large amounts of plant residue can be grown continuously if the residue is returned to the soil. Fertilizing increases plant growth and provides more plant residue to reduce soil blowing. Stripcropping and planting winter cover crops following row crops also protect the soil. Conservation tillage needs to be used.

The Larton soil has medium potential for native grasses and tame pasture. The quality and quantity of

forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer also increases growth of tame pasture plants.

This soil has high potential for most urban uses. Limitations for most building site development or sanitary facilities are insignificant; however, the use of this soil is limited for sewage lagoons by slope and for lawns by droughtiness. Good structural design to compensate for soil acidity is needed for concrete.

This Larton soil is in capability subclass IIIe and in the Deep Sand Savannah range site.

33—Larton loamy fine sand, 3 to 8 percent slopes. This soil is deep, gently sloping or moderately sloping and well drained. It is on ridge crests and side slopes of terraces. The side slopes are 2 to 6 feet high and 100 to 400 feet apart. Individual areas are mostly 30 to 150 acres, but some areas are about 10 acres.

Typically the surface layer is dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is brown loamy fine sand to a depth of about 21 inches. The subsoil extends to a depth of about 72 inches. It is red sandy clay loam to a depth of about 38 inches, light reddish brown sandy clay loam to a depth of about 62 inches, and yellowish red and yellowish brown sandy clay loam and sandy loam below that.

This soil is medium in natural fertility, and the organic matter content is low. The soil is slightly acid or medium acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity in the upper 40 inches is low to moderate. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Glenpool and Kamie soils. Also included are a few small spots of Kamie soils that are eroded. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Larton soil is used for tame pasture plants, wheat, grain sorghums, and soybeans. In a few areas, it has been planted to trees or range plants.

This soil has low potential for cultivated crops. Fertilizing to obtain large amounts of crop residue is desirable to reduce soil blowing and water erosion. Contour tillage, strip crops, cover crops, and crop residue left on the soil help to control erosion and improve soil fertility. Row crops can be planted if the soil is fertilized, crop residue is managed, and a cover crop is used. Excessive tillage needs to be avoided. Use of this soil as tame pasture, range, or woodland provides the best protection against erosion.

The Larton soil has medium potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer also increases growth of tame pasture plants.

This soil has high potential for most urban uses. The main concerns in using this soil in urban areas are slope, seepage, and soil acidity. This soil is well suited to trees, garden plants, shrubs, and flowers. Limitations for septic tank absorption fields, sanitary landfills, and dwellings are significant. Slope is a limitation for commercial buildings, sewage lagoons, or playground areas. Soil acidity is a concern for concrete.

This Larton soil is in capability subclass IVe and in the Deep Sand Savannah range site.

34—Larton loamy fine sand, 3 to 12 percent slopes, gullied. This soil is deep, well drained, gently sloping to strongly sloping, and severely eroded. It is on terraces. Slopes are smooth and slightly convex except around gullies. Individual areas are mostly 20 to 80 acres, but some areas are 5 acres.

Gullies caused by water erosion range from 5 to 15 feet deep, 10 to 20 feet wide, and are 200 to 400 feet apart. Between gullies, the surface layer has been removed by erosion in 50 percent of the area. In 20 percent of the area, the surface layer and the upper part of the subsoil have been mixed by cultivation. In these places, the surface layer is fine sandy loam, loamy fine sand, and sandy clay loam.

Typically, the surface layer is brown loamy fine sand about 11 inches thick. The subsurface layer is brown loamy fine sand to a depth of about 23 inches. The subsoil extends to a depth of about 72 inches. It is red sandy clay loam to a depth of about 39 inches, red fine sandy loam to a depth of about 55 inches, and yellowish red fine sandy loam below that.

This soil is low in natural fertility and organic matter content. The surface layer is slightly acid to strongly acid. Permeability is moderate, and the available water capacity is low to moderate. The root zone is deep. Surface runoff is somewhat excessive.

Included with this soil in mapping are intermingled areas of Glenpool and Kamie soils. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 8 acres.

This Larton soil is mostly used as native range or woodland.

This soil has low potential for cultivated crops. The deep gullies are a limitation, and erosion is a very severe hazard.

This soil has low potential for native grasses and medium potential for tame pasture. The main concerns in management are preventing further erosion and maintaining soil tilth and fertility. Fertilizing, diverting upslope water, and reshaping gully banks are needed to successfully establish tame pasture. The quality and quantity of all forage can be improved by proper grazing, controlling weeds and brush, and preventing wildfires.

This soil has high potential for most urban uses. In some areas, the gullies should be shaped and filled. This soil has no significant limitations for dwellings, roads and streets, and sanitary landfills. Slope limits its use for sewage lagoons.

This Larton soil is in capability subclass VIe and in the Eroded Sandy Savannah range site.

35—Latanier silty clay loam, rarely flooded. This soil is deep, somewhat poorly drained, and nearly level. It is on the Arkansas River bottom lands. Slopes are smooth or very gently undulating and are less than 1 percent. Individual areas are mostly 30 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is dark reddish brown silty clay loam about 11 inches thick. The subsoil, to a depth of about 35 inches, is dark reddish brown silty clay. The underlying material to a depth of about 71 inches is dark reddish brown loam that has strata of very fine sandy loam and silt loam.

This soil is high in natural fertility, and the organic matter content is low to moderately high. The surface layer is neutral to moderately alkaline. Permeability is very slow, and the available water capacity is high. Because of the silty clay loam surface layer, this soil cannot be tilled throughout a wide range of moisture content. An apparent high water table is at a depth of 1 foot to 3 feet during the winter and spring.

Included with this soil in mapping are intermingled areas of Roxana and Severn soils and areas of Roebuck soils in lower positions than the Latanier soil. The included soils make up about 10 percent of the map unit, but areas of these soils generally are less than 3 acres.

This soil is used mainly for cultivated crops. It has medium potential for row crops and small grains. Good tilth can be maintained by returning crop residue to the soil. Flooding is rare, and erosion is a slight hazard. Liming is not needed, but fertilization normally is beneficial.

This soil has high potential for tame pasture and native grasses. Bermudagrass is commonly grown for forage. Concerns in management include proper grazing, controlling brush, and preventing wildfires. Fertilizing increases forage production, and the additional plant growth helps control erosion during flooding.

Because of flooding, this soil has low potential for most urban uses and camp areas. Because of the wet silty clay loam surface layer, this soil has limitations for picnic areas and playgrounds.

This soil has high potential for use as habitat for wildlife. Numbers of wildlife are limited because of the scarcity of food and cover in many clean-tilled areas.

This Latanier soil is in capability subclass IIIw and in the Heavy Bottomland range site.

36—Lightning silt loam, occasionally flooded. This soil is deep, somewhat poorly drained, and nearly level. It is on smooth to slightly concave flood plains of small streams. Slopes are 0 to 1 percent. Individual areas are generally 25 to 50 acres, but some areas are smaller.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown silt loam to a depth of about 14 inches. The subsoil extends to a depth of 62 inches. It is dark grayish brown silty clay loam to a depth of about 22 inches, and dark gray and gray silty clay below that. The underlying material is coarsely mottled dark gray and yellowish brown silty clay to a depth of at least 80 inches.

This soil is high in natural fertility, and the organic matter content is low. The surface layer is strongly acid to neutral. Permeability is very slow, and the available water capacity is high. A perched high water table is at a depth of less than 2 feet in the winter and spring. This soil has fair tilth and can be worked only within a moderate range of moisture content. The root zone is deep and fairly easily penetrated by plant roots.

Included with this soil in mapping are intermingled ares of Cupco and Verdigris soils. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 3 acres.

This Lightning soil is used mainly as cropland. Small grains, grain sorghums, soybeans, alfalfa, and bermudagrass are the main crops.

This soil has medium potential for row crops and small grains, and good yields can be obtained. Wetness, low fertility, and surface crusting are limitations. The erosion hazard from flooding can be decreased by maintaining a crop cover during the flooding season. A drainage system, large amounts of crop residue returned to the soil, and proper fertilization are needed to increase crop yields.

This soil has high potential for tame pasture and medium potential for native grasses. Flooding is a hazard. Fescue and clovers are best adapted to this soil for tame pasture, but good yields can be obtained from bermudagrass and clovers. Maintaining the fertility level and pasture management are important for tame pasture. The quality and quantity of forage can be improved by proper stocking and grazing, preventing wildfires, and controlling weeds and brush.

This soil has low potential for most urban uses. The wetness, shrink-swell potential, and flood hazard are difficult to overcome. The very slow permeability is a limitation for septic tank absorption fields. This limitation can be partly overcome by increasing the size of the absorption area or by modifying the filter field. The flood hazard can be reduced but not completely eliminated by upstream flood control structures. The potential for flooding is high for houses built on the flood plain.

This Lightning soil is in capability subclass IIIw and in the Heavy Bottomland range site.

37—Linker fine sandy loam, 1 to 3 percent slopes. This soil is moderately deep, very gently sloping, and well drained. It is on slightly convex, smooth slopes of uplands. Individual areas are mostly 40 to 250 acres, but some areas are about 15 acres.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of about 39 inches. It is strong brown fine sandy loam to a depth of about 12 inches and red sandy clay loam below that. The underlying material to a depth of 50 inches is acid sandstone in shades of red and brown.

This soil is low in natural fertility, and the organic matter content is low to moderate. The surface layer is generally strongly acid, but it ranges from strongly acid to slightly acid where lime has been added. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity in the upper 40 inches is moderate to high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Enders, Endsaw, Oktaha, and Hector soils. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

Linker soil is used mostly for grain sorghum, hay, and pasture. In a few areas, it is used as woodland. White, red, post, and blackjack oaks are the common trees. In other areas, this soil is used for native grasses, recreational activities, or as habitat for wildlife.

This soil has high potential for cultivated crops. The main concerns in management are controlling soil erosion and maintaining soil tilth and fertility. Terracing is needed where the soil is eroding. Fertilizing increases plant growth and provides more crop residue to help maintain soil tilth and fertility. Contour farming in sloping areas, stripcropping, and returning crop residue to the soil help control erosion. Winter cover crops following row crops furnish additional soil protection against wind and water action. Conservation tillage is needed.

The Linker soil has medium potential for native grasses and high potential for tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer also increases growth of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

The Linker soil has low potential for most urban uses. Depth to bedrock is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, and local roads and streets.

This Linker soil is in capability subclass IIe and in the Sandy Savannah range site.

38—Linker fine sandy loam, 3 to 5 percent slopes. This soil is moderately deep, gently sloping, and well drained. It is on slightly convex, smooth slopes of uplands. Individual areas are mostly 25 to 150 acres, but some areas are about 15 acres.

Typically, the surface layer is dark yellowish brown fine sandy loam about 4 inches thick. The subsoil extends to a depth of about 37 inches. It is yellowish red fine sandy loam to a depth of about 10 inches and yellowish red sandy clay loam below that. The underlying material is reddish brown acid sandstone.

This soil is low in natural fertility, and the organic matter content is low to moderate. The surface layer is generally strongly acid, but it ranges from strongly acid to slightly acid where lime has been added. Lime and plant foods are needed for most crops. Permeability is moderate, and the available water capacity in the upper 40 inches is moderate to high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Enders, Hector, and Oktaha soils. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

This Linker soil is used mostly for grain sorghum, hay, and pasture. In a few areas, it is used for native grasses or as woodland. In other areas, it is used for recreational activities or as habitat for wildlife.

This soil has medium potential for cultivated crops. In cultivated areas, this soil is subject to soil blowing and water erosion. Terraces, contour tillage, and crop residue returned to the soil help control erosion and improve soil structure and fertility. Conservation tillage needs to be used.

The Linker soil has medium potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

The Linker soil has low potential for most urban uses. Depth to bedrock is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, and local roads and streets.

This Linker soil is in capability subclass IIIe and in the Sandy Savannah range site.

39—Mason silt loam, rarely flooded, 0 to 1 percent slopes. This soil is deep, nearly level, and well drained and moderately well drained. It is on broad, smooth flood plains. Individual areas are generally 30 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown silt loam to a depth of 14 inches. The subsoil is silty clay loam. It extends to a depth of about 62 inches. The subsoil is very dark brown to a depth of about 27 inches and dark brown and brown below that.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is medium acid to neutral. Lime and plant food are needed for most crops. Permeability is moderately slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are Caspiana and Garton soils. The Caspiana soils are in higher positions than the Mason soil, and the Garton soils are in lower positions. Also included are soils similar to the Mason soil except the subsoil is more clayey. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

This Mason soil is used mostly for grain sorghums, soybeans, and small grains. In some areas, it is used as tame pasture. Other areas are under forest of elm, oak, hickory, and pecan.

This soil has high potential for cultivated crops. Soil management is needed to maintain soil tilth and fertility. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and most of the crop residue is returned to the soil. Fertilizing helps to maintain organic matter content, good tilth, and fertility.

This soil has high potential for native grasses and tame pasture. A mixture of bermudagrass and clover is most commonly used for tame pasture. Controlling brush, deferring grazing, fertilizing, and preventing wildfires improve the quality and amount of forage.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses, but it is well suited to trees, shrubs, flowers, and lawn grasses. Flooding is the main concern in management of this soil for dwellings, commercial buildings, camp areas, and garden plants. This soil also has limitations for septic tank absorption fields, sewage lagoons, and sanitary landfills. The flood hazard can be reduced by upstream flood control structures.

This Mason soil is in capability class I and in the Loamy Bottomland range site.

40—Mason silt loam, rarely flooded, 1 to 3 percent slopes. This soil is deep, very gently sloping, and well drained and moderately well drained. It is on smooth, slightly convex flood plains. Individual areas are mostly 30 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The next layer to a depth of about 16 inches is dark brown silt loam. The subsoil is silty clay loam. It extends to a depth of about 46 inches. The subsoil is dark brown to a depth of about 26 inches, brown to a depth of about 34 inches, and dark yellowish brown below that. The underlying material to a depth of about 65 inches is grayish brown silty clay loam.

This soil is high in natural fertility, and the organic matter content is moderately high. The surface layer is medium acid to neutral. Lime and plant food are needed for most crops. Permeability is moderately slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are Caspiana and Garton soils. The Caspiana soils are in higher positions than the Mason soil, and the Garton soils are in lower positions. Also included are soils similar to the Mason soil except the subsoil is more clayey. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

This Mason soil is used mostly for grain sorghums, soybeans, and small grains. In some areas, it is used as tame pasture. Other areas are under forest of elm, oak, hickory, and pecan.

This soil has high potential for cultivated crops. Soil management is needed to maintain soil tilth and fertility. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and most of the crop residue is returned to the soil. Fertilizing helps to maintain organic matter content, good tilth, and fertility. Terraces and contour farming are needed where the soil is eroding. Conservation tillage also helps to control erosion.

This soil has high potential for native grasses and tame pasture. A bermudagrass and clover mixture is most commonly used for tame pasture. Preventing wildfires, controlling brush, proper grazing, and fertilizing improve the quality and amount of forage.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses, but it is well suited to trees, shrubs, flowers, and lawn grasses. Flooding is the main concern in management of this soil for dwellings, commercial buildings, camp areas, and garden plants. This soil also has limitations for septic tank absorption fields, sewage lagoons, and sanitary landfills. The flood hazard can be reduced by upstream flood control structures.

This Mason soil is in capability subclass IIe and in the Loamy Bottomland range site.

41—Muldrow silty clay loam, rarely flooded. This soil is deep, nearly level, and somewhat poorly drained. It is on smooth to slightly concave benches of flood plains. Slopes are 0 to 1 percent. Individual areas are

mostly 20 to 65 acres, but some areas are about 5 acres.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil extends to a depth of about 67 inches. It is dark gray silty clay loam to a depth of about 27 inches, dark gray silty clay to a depth of about 47 inches, and brown silty clay loam below that. The underlying material is brown, massive silty clay loam to a depth of about 80 inches.

This soil is high in natural fertility, and the organic matter content is moderate or moderately high. The surface layer is generally medium acid to neutral; it can be mildly alkaline where lime has been added. Lime and plant food are needed for most crops. Permeability is very slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. An apparent high water table is at a depth of less than 2 feet from fall to spring.

Included with this soil in mapping are the Mason and Garton soils. These soils are in higher positions than the Muldrow soil. Also included are soils similar to the Muldrow soil except they have an abrupt textural change between the surface layer and the subsoil. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 3 acres.

This Muldrow soil is used mostly for soybeans and small grains; lesser amounts are used for grain sorghums, alfalfa, and tame pasture. Some areas remain under forest of mixed hardwoods with an understory of grasses.

This soil has high potential for cultivated crops. Soil management is needed to maintain drainage, soil tilth, and fertility. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and most of the crop residue is returned to the soil. Fertilizing helps to maintain organic matter content, good tilth, and fertility. A drainage system and rows arranged for drainage reduce surface wetness.

This soil has high potential for tame pasture and native grasses. A combination of bermudagrass or fescue and clover is commonly used for hay and pasture. The main concerns in management include controlling brush, proper grazing, and preventing wildfires. Fertilizing increases forage production; the additional plant growth helps control erosion during flooding.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. Things to consider are wetness, clayey subsoil, flooding, and shrink-swell potential. Wetness is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, dwellings, small commercial buildings, and local roads and streets.

This Muldrow soil is in capability subclass IIw and in the Heavy Bottomland range site.

42—Norwood silt loam, rarely flooded. This soil is deep, well drained, and nearly level. It is on Arkansas River bottom lands. Slopes are 0 to 1 percent. Individual areas are mostly 30 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is reddish brown silt loam about 10 inches thick. The subsoil, to a depth of about 38 inches, is reddish brown silt loam. The underlying material to a depth of about 65 inches is reddish brown silt loam that is stratified with thin layers of silty clay loam.

This soil is high in natural fertility, and the organic matter content is low to moderate. It is mildly alkaline or moderately alkaline. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are a few intermingled areas of Keo and Severn soils. The included soils make up about 10 percent of the map unit, but areas of these soils generally are less than 3 acres.

This Norwood soil is used mainly for cultivated crops. It has high potential for row crops and small grains. Good tilth can be maintained by returning crop residue to the soil. Flooding is rare, and erosion is a slight hazard. Liming is not needed, but fertilization normally is beneficial. Excessive tillage should be avoided.

This soil has high potential for native grasses and tame pasture. A mixture of bermudagrass and clover is commonly used for tame pasture. Controlling brush, proper grazing, fertilizing, and preventing wildfires improves the quantity and quality of grasses.

Because of rare flooding, this soil has low potential for most urban uses and camp areas. It has high potential for picnic areas and playgrounds and as habitat for wildlife. Numbers of wildlife are limited because of scarcity of food and cover in clean-tilled areas.

This Norwood soil is in capability class I and in the Loamy Bottomland range site.

43—Oil-waste land. Oil-waste land consists of areas where liquid wastes, principally oil and salt water, have accumulated. It includes slush pits and adjacent uplands and bottom lands. Oil-waste land is in all parts of the county near oil drilling or refining operations. Individual areas are generally about 0.5 acre to 40 acres.

Oil-waste land generally has a loamy surface layer and a loamy or clayey subsoil. The underlying material is weathered sandstone, limestone, or shale, or it is alluvium. Slope is 0 to 5 percent. Surface runoff is rapid, and erosion is a severe hazard.

Oil-waste land is not suitable for farming or urban use. Some of it could be reclaimed, but the cost would be high because surface drainage from higher areas would

have to be diverted. Rainwater could be impounded to help leach out soluable salts. A mulch of hay or straw would reduce evaporation and thus help prevent salt accumulations on the surface.

Very little vegetation grows in these areas (fig. 8). Salt-tolerant pasture plants could be grown if they were seeded in the middle of the rainy season when salt accumulations on the surface are reduced.

This map unit is in capability subclass VIIIs. It is not assigned to a range site.

44—Okay very fine sandy loam, 0 to 1 percent slopes. This soil is deep, nearly level, and well drained. It is on broad, smooth river terraces. Individual areas are mostly 20 to 200 acres, but some areas are about 5 acres.

Typically, the surface layer is dark brown very fine sandy loam about 18 inches thick. The subsoil extends to a depth of about 65 inches. It is dark grayish brown loam to a depth of about 26 inches, brown clay loam to a depth of about 45 inches, and brown sandy clay loam below that.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is medium acid to neutral. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity in the upper 40 inches is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are areas of Caspiana and Mason soils. Caspiana and Mason soils are on the same terrace but slightly lower on the landscape than the Okay soil. The included soils make up about 10 percent of this map unit, but areas of these soils are generally less than 3 acres.

This Okay soil is used mostly for field crops and tame pasture plants.

Figure 8.—Vegetation is sparse in areas of Oil-waste land.

This soil has high potential for cultivated crops, and it is suited to wheat, vegetables, soybeans, and grain sorghum. Controlling erosion and maintaining soil tilth and fertility are the main concerns in management. This soil can be used for continuous clean-tilled crops if it has been adequately fertilized and crop residue has been returned to the soil. Crop residue helps maintain soil tilth and improve water intake. In a few areas, diversion terraces on long slopes are used to prevent excessive sheet erosion.

This soil has high potential for native grasses and tame pasture. A mixture of bermudagrass and clover is commonly used for hay and pasture. The quality and quantity of all forage can be improved by controlling weeds and brush, proper stocking, and preventing wildfires.

This soil has high potential for most urban uses. The main concerns in using this soil in urban areas are moderate permeability and soil acidity. This soil is well suited to trees, garden plants, shrubs, flowers, and camp, playground, or picnic areas, but is has limitations for septic tank filter fields and area-type sanitary landfills. Seepage is the main soil feature to consider when planning to use this soil for sanitary landfill and sewage lagoons. Soil acidity is the main concern for uncoated steal or concrete pipe. Limitations for dwellings and commercial buildings are insignificant.

This Okay soil is in capability class I and in the Loamy Prairie range site.

45—Okay very fine sandy loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and well drained. It is on broad, smooth river terraces. Individual areas are mostly 50 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown very fine sandy loam about 18 inches thick. The subsoil extends to a depth of about 65 inches. It is dark grayish brown loam to a depth of about 26 inches, brown clay loam to a depth of about 45 inches, and brown sandy clay loam below that.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is medium acid to neutral. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are areas of Caspiana and Mason soils. Caspiana and Mason soils are on the same terrace but slightly lower on the landscape than the Okay soil. The included soils make up about 5 percent of this map unit, but areas of these soils are generally less than 3 acres.

This Okay soil is used mostly for field crops and tame pasture plants.

This soil has high potential for cultivated crops. Wheat, vegetables, soybeans, and grain sorghum are the main crops. Soil management is needed to maintain fertility and soil tilth and to control erosion. Cropping systems need to provide for the return of adequate residue to the soil. Erosion can be reduced by contour farming, terracing, and managing crop residue. Vegetative cover is needed during winter and spring to help keep the soil from eroding. Fertilizing increases plant growth and provides additional crop residue for erosion control. Terraces, contour tillage, and cover crops are especially needed if row crops are grown. Excessive tillage needs to be avoided.

This soil has high potential for native grasses and tame pasture. A mixture of bermudagrass and clover is commonly used for hay and pasture. The quality and quantity of all forage can be improved by controlling weeds and brush, proper stocking, and preventing wildfires.

This soil has high potential for most urban uses. The main concerns in using this soil in urban areas are slope and soil acidity. The soil is well suited to trees, garden plants, shrubs, and flowers. It has no significant limitation for buildings and camp or picnic areas. Seepage is the main limitation for lagoons and sanitary landfills. Slope of more than 2 percent is a restricting feature for sewage lagoons and playground areas. Soil acidity is a concern on this soil where it is used for uncoated steal or concrete pipe.

This Okay soil is in capability subclass IIe and in the Loamy Prairie range site.

46—Okemah silt loam, 0 to 1 percent slopes. This soil is deep, moderately well drained, and nearly level. It is on the lower slopes of uplands. Individual areas are mostly 20 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The next layer is black silty clay loam to a depth of about 16 inches. The subsoil extends to a depth of about 65 inches. It is very dark gray silty clay loam to a depth of about 21 inches, dark grayish brown clay to a depth of 42 inches, and coarsely mottled yellowish red and gray clay below that.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is medium acid to neutral. Permeability is slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and fairly easily penetrated by plant roots. A perched high water table is between depths of 2 and 3 feet in the winter and spring.

Included with this soil in mapping are areas of Dennis, Parsons, and Taloka soils on middle and lower side slopes. The included soils make up about 10 to 15

percent of the map unit, but areas of these soils generally are less than 3 acres.

This Okemah soil is used mainly for small grains, soybeans, grain sorghum, corn, alfalfa, tame pasture plants, and native range.

This soil has high potential for row crops. Good tilth is easily maintained by returning crop residue to the soil.

This soil has high potential for native grasses and tame pasture. The forage can be maintained or improved by controlling grazing, preventing wildfires, and controlling brush. Fertilizing tame pasture increases production; the additional plant growth helps protect the soil from erosion.

This soil has low potential for most urban uses. The high shrink-swell potential and low strength are limitations for buildings and roads and streets. These limitations can be overcome by good design and careful installation. The slow permeability in the clayey subsoil is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This Okemah soil is in capability class I and in the Loamy Prairie range site.

47—Oktaha fine sandy loam, 1 to 3 percent slopes. This soil is moderately deep, very gently sloping, and well drained. It is on uplands. Slopes are smooth and slightly convex. Individual areas are mostly 20 to 250 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown fine sandy loam about 5 inches thick. The subsurface layer, to a depth of 10 inches, is dark yellowish brown fine sandy loam. The subsoil extends to a depth of about 35 inches. It is yellowish brown sandy clay loam to a depth of about 30 inches and yellowish brown loam below that. The underlying material to a depth of about 38 inches is red, hard sandstone that is partly weathered in the upper few inches.

This soil is low in natural fertility and organic matter content. The surface layer is very strongly acid to slightly acid, but it is neutral where lime has been added. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is moderate to high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Hector, Linker, and Enders soils and small areas of Spiro soils. The included soils make up about 20 percent of the map unit, but areas of these soils generally are less than 3 acres.

Oktaha soil is used mostly for sorghum, soybeans, and small grains. In a few areas, it is used as native pasture, tame pasture, or woodland. In other areas, this soil is used for recreational activities or as habitat for wildlife.

This soil has high potential for cultivated crops. The main concerns in management are controlling soil erosion and maintaining soil tilth and fertility. Terraces are needed if the soil is eroding. Fertilizing increases plant growth and provides more crop residue to help maintain soil tilth, fertility, and uptake of water. Contour tillage, strip crops, and crop residue returned to the soil help to control erosion. Winter cover crops following row crops furnish additional protection against wind and water action.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has medium potential for native grasses and high potential for tame pasture. Bermudagrass combined with clover is the most common mixture used for hay and pasture. Fertilizing increases forage production, thereby helping to control erosion. The quality and quantity of all forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by wildfires.

This soil has low potential for most urban uses. Depth to bedrock is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass IIe and in the Sandy Savannah range site.

48—Oktaha fine sandy loam, 3 to 5 percent slopes. This soil is moderately deep, gently sloping, and well drained. It is on smooth, slightly convex slopes on uplands. Individual areas are mostly 25 to 250 acres, but some areas are about 10 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer to a depth of about 16 inches is yellowish brown fine sandy loam. The subsoil is sandy clay loam. It extends to a depth of about 39 inches. It is strong brown to a depth of about 29 inches and yellowish brown below that. The underlying material is acid sandstone bedrock.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is very strongly acid to slightly acid. Lime and plant food are necessary for most crops. Permeability is moderate, and the available water capacity is moderate to high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Hector, Linker, and Enders soils. The included soils make up about 15 percent of the map unit, but areas of these soils generally are less than 3 acres.

Oktaha soil is used mostly for cultivated crops, such as sorghum, soybeans, and wheat. Some acreage is in pasture. More than 25 percent of this soil is used as woodland.

This soil has medium potential for cultivated crops. The main concerns in management are controlling soil erosion and maintaining soil fertility and tilth. Terraces

and contour tillage are needed to control erosion if row crops are grown. Fertilizing increases plant growth, and the increased crop residue helps to control erosion and increases water intake and soil fertility. Conservation tillage helps keep crop residue in the surface layer.

Wooded areas can be maintained and improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

The Oktaha soil has medium potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has low potential for most urban uses. Depth to bedrock is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, and dwellings with basements.

This Oktaha soil is in capability subclass IIIe and in the Sandy Savannah range site.

49—Oktaha fine sandy loam, 2 to 5 percent slopes, eroded. This soil is moderately deep, very gently sloping or gently sloping, and well drained. It is on broad, smooth, convex slopes of plateaus, mountaintops, and hilltops. In about 40 percent of the area, the original surface layer and material from the subsoil are mixed by plowing. There are a few crossable gullies about 350 feet apart. Rills are common between the gullies. Individual areas are mostly 50 to 350 acres, but some areas are about 10 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer to a depth of about 11 inches is light grayish brown fine sandy loam. The subsoil is yellowish brown sandy clay loam to a depth of about 34 inches. The underlying material is hard sandstone.

Oktaha soil is medium in natural fertility, and the organic matter content is low. The surface layer is very strongly acid to slightly acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is moderate to high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Hector, Linker, and Enders soils. The included soils make up about 15 percent of the map unit, but areas of these soils generally are less than 3 acres.

Oktaha soil is used mainly for cultivated crops, such as sorghum, soybeans, and wheat. More than 25 percent of this soil has reverted to use as woodland, and in some areas, the soil is used for pasture.

This soil has medium potential for cultivated crops. Intensive management is needed to control soil erosion. Terracing, contour farming, returning crop residue to the soil, and fertilizing are needed. Plant cover protects against wind and water erosion in winter and spring. Deterioration of soil structure and loss of fertility can also be controlled by these practices.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

The Oktaha soil has medium potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizer increases growth of tame pasture plants.

This soil has low potential for most urban uses. Depth to bedrock is the main limitation for septic tank absorption fields, sewage lagoons, buildings, roads and streets, and for use as roadfill material.

This Oktaha soil is in capability subclass IIIe and in the Sandy Savannah range site.

50—Oktaha-Hector fine sandy loams, 1 to 5 percent slopes. This complex is made up of the Oktaha and Hector soils on smooth, convex side slopes and narrow ridge crests of upland. These soils are well drained and very gently sloping or gently sloping. The Oktaha soil is moderately deep, and the Hector soil is shallow. These soils are so intricately mixed that mapping them separately is not practical. Individual areas are mostly 30 to 150 acres, but some areas are about 10 acres.

The Oktaha soil makes up about 60 percent of the map unit. Typically, the surface layer is brown fine sandy loam about 3 inches thick. The subsurface layer, to a depth of about 6 inches, is grayish brown fine sandy loam. The subsoil, to a depth of about 24 inches, is yellowish brown sandy clay loam. The underlying material is reddish brown, acid sandstone that extends below a depth of 40 inches.

The Oktaha soil is low in natural fertility and organic matter content. The surface layer is very strongly acid to slightly acid. Lime and plant food are needed for most crops. Permeability is moderate, and the available water capacity is moderate to high. The root zone is moderately deep. This soil has good tilth and can be worked throughout a wide range of moisture content.

The Hector soil makes up about 30 percent of the map unit. Typically, the surface layer is brown fine sandy loam about 11 inches thick. The subsoil, to a depth of 17 inches, is brown fine sandy loam. The underlying material is brown, acid sandstone to a depth of 30 inches.

The Hector soil is low in natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and the available water capacity is moderate. The root zone is shallow, and this soil has poor tilth.

Included with these soils in mapping are intermingled areas of Enders, Linker, and Spiro soils. The included soils make up about 10 percent of the map unit, but areas of these soils generally are less than 3 acres.

The soils in this complex are used mainly for tame pasture plants, wheat, grain sorghum, and soybeans. In a few areas, they have been seeded to trees or range plants.

These soils have low potential for cultivated crops. The main concerns in management are rockiness and shallowness of the soil to sandstone. Management is needed to control erosion and improve fertility. Fertilizing increases plant growth, and the large amounts of crop residue reduce loss of soil by soil blowing and water erosion. Contour tillage, strip crops, cover crops, and return of crop residue to the soil control erosion and improve soil fertility. Row crops can be planted if the soil is fertilized, residue is managed, and a cover crop is used. Terraces help control erosion, but the shallow depth of the Hector soil is a limitation in construction. Excessive tillage needs to be avoided. Use of these soils for tame pasture, range, or woodland provides the best protection against erosion.

These soils have medium potential for native grasses and low potential for tame pasture. Bermudagrass combined with clover is the most common mixture used for hay and pasture. Fertilizing increases forage production, thereby helping to control erosion. The quality and quantity of all forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by wildfires.

These soils have low potential for most urban uses. The main concerns are depth to bedrock, slope, and small stones. The shallow depth of the Hector soil is the main limitation for septic tank filter fields, sewage lagoons, trench-type sanitary landfills, dwellings, commercial buildings, and roads and streets. Depth to bedrock must be considered in excavating.

These Oktaha and Hector soils are in capability subclass IVe. The Oktaha soil is in the Sandy Savannah range site, and the Hector soil is in the Shallow Savannah range site.

51—Osage silty clay loam, rarely flooded. This soil is deep, nearly level, and poorly drained. It is on broad, smooth flood plains that have slightly concave slopes in some areas. Slopes are 0 to 1 percent. Individual areas are mostly 40 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The next layer, to a depth of about 16 inches, is very dark grayish brown silty clay loam. The subsoil is very dark grayish brown silty clay to a depth of about 68 inches.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface is strongly acid to mildly alkaline. Lime and plant food are needed for most crops. Permeability is very slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a medium range of moisture content. An apparent high water table is at a depth of less than 1 foot during the winter and spring.

Included with this soil in mapping are Lightning, Verdigris, and Muldrow soils and soils similar to the Osage soil except they are flooded more frequently and have a less clayey surface layer. The similar soils are on nearby flood plains and low terraces. The included soils make up about 20 percent of the map unit, but areas of these soils are less than 5 acres.

Osage soil is used mostly for soybeans, small grains, grain sorghums, and alfalfa. In a few areas, it is used as tame pasture, woodland, habitat for wildlife, or for recreational activities.

This soil has medium potential for cultivated crops. The main concerns in management are flooding, surface wetness, slow water intake, and soil tilth. Close-grown crops are needed late in fall and in winter and spring to prevent excessive loss of soil during flooding. The planting of spring crops needs to be delayed until after the flood periods. Most crops can be grown continuously if the soil has been fertilized for maximum crop residue. Large amounts of residue help maintain organic matter and contribute to good soil tilth and intake of water. When this soil is wet, tillage or grazing breaks down soil structure and reduces water intake. Proper row arrangement helps drainage, which reduces surface wetness and allows for better crop growth.

This soil has high potential for tame pasture and native grasses. A combination of bermudagrass or fescue and clover is commonly used for hay and pasture. The main concerns in management include controlling grazing and preventing fires. Fertilizing increases forage production; the additional plant growth helps control erosion during flooding.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses, but it is well suited to trees, shrubs, most flowers, and some garden plants. The main concerns are flooding, the clayey texture, wetness, and high shrink-swell potential. Good structural design to compensate for high shrink-swell potential, flooding, and wetness is especially needed where the soil is used for dwellings, commercial buildings, and roads and streets. Wetness is the main concern in areas where this soil is used for septic tank absorption fields, sanitary landfills, paths and trails, and camp and picnic or playground areas.

This Osage soil is in capability subclass IIIw and in the Heavy Bottomland range site.

52—Parsons silt loam, 0 to 1 percent slopes. This soil is deep, somewhat poorly drained, and nearly level. It is on smooth uplands. Individual areas are mostly 30 to 250 acres, but some areas are about 10 acres.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is clay. It extends to a depth of about 65 inches. It is very dark grayish brown to a depth of about 30 inches, grayish brown to a depth of about 45 inches, and mottled gray and strong brown below that.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is strongly acid to slightly acid. Permeability is very slow, and the available water capacity is high. The soil has fair tilth and can be worked throughout a medium range of moisture content. The root zone is fairly deep and fairly easily penetrated by plant roots. A perched high water table is between depths of 0.5 foot and 1.5 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Dennis, Okemah, and Taloka soils. The included soils make up about 10 to 15 percent of the map unit, but areas of these soils are mostly less than 3 acres.

This Parsons soil is used mainly for small grains, grain sorghum, soybeans, tame pasture plants, and native grasses.

This soil has high potential for most cultivated crops. The main concerns in management are maintaining tilth, increasing intake of water, and controlling erosion on long slopes and surface crusting, seasonal wetness, or droughtiness. This soil can be used continuously for clean-tilled crops if adequate fertilizer is added and if crop residue is returned to the soil. A large amount of crop residue helps maintain organic matter content and tilth, increases water intake, and prevents surface crusting. Winter cover crops furnish protection against erosion. In a few areas, diversion terraces on long slopes can reduce erosion. A drainage system and rows arranged for drainage reduce surface wetness and increase crop production. Tillage should be timely and kept to a minimum.

This soil has medium potential for native grasses and tame pasture. A mixture of bermudagrass or tall fescue and clover is commonly used for pasture. Controlling weeds, proper grazing, and preventing wildfires improve the quality and quantity of forage. Fertilizer also improves the forage production of tame pasture.

This soil has low potential for urban uses. The high shrink-swell potential is the main limitation for dwellings, small commercial buildings, and roads and streets. Wetness limits the use of this soil for sanitary facilities. This limitation can be overcome by proper structural design or by altering the soil.

This Parsons soil is in capability subclass IIs and in the Claypan Prairie range site.

53—Parsons silt loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and somewhat poorly drained. It is on smooth, slightly convex uplands. Individual areas are mostly 50 to 200 acres, but some areas are about 15 acres.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer, to a depth of 12 inches, is dark grayish brown silt loam. The subsoil is clay. It extends to a depth of about 50 inches. It is grayish brown to a depth of 16 inches, dark grayish brown to a depth of 29 inches, and light olive brown below that. The underlying material to a depth of more than 62 inches is gray and yellowish brown clay.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is strongly acid to slightly acid. Lime and plant food are needed for most crops. Permeability is very slow, and the available water capacity is high. This soil has fair tilth and can be worked throughout a medium range of moisture content. A perched high water table is between depths of 0.5 foot and 1.5 feet during winter and spring.

Included with this soil in mapping are Dennis and Taloka soils and lesser amounts of Okemah soils. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 6 acres.

Parsons soil is used mainly for small grains, sorghums, and soybeans. In small areas, it is used for tame pasture or native grasses and hayland.

This soil has medium potential for small grains and other sown crops. The main concerns in management are maintaining tilth, increasing intake of water and controlling erosion on long slopes, surface crusting, seasonal wetness, and droughtiness. This soil needs a large amount of crop residue to help maintain organic matter content and tilth, increase water intake, and prevent surface crusting. Winter cover crops protect against erosion. Terraces on long slopes can also reduce erosion. Tillage should be timely and kept to a minimum.

This soil has medium potential for native grasses and tame pasture. A mixture of bermudagrass or tall fescue and clover is commonly used for pasture. Controlling weeds, proper grazing, and preventing wildfires improve the quality and quantity of forage. Fertilizer increases forage production of tame pasture.

This soil has low potential for urban uses. The high shrink-swell potential is the main limitation for dwellings, small commercial buildings, and roads and streets. Wetness limits the use of this soil for sanitary facilities. This limitation can be overcome by proper structural design or by altering the soil.

This Parsons soil is in capability subclass IIIe and in the Claypan Prairie range site.

54—Parsons silt loam, 1 to 3 percent slopes, eroded. This soil is deep, somewhat poorly drained, and very gently sloping. It is on upland prairies in the western

part of the county. Slopes are smooth and slightly convex except in eroded areas. In about 40 percent of the map unit, the surface layer and material from the upper part of the subsoil are mixed by plowing. A few crossable gullies are about 300 feet apart. Rills are common between the gullies. Individual areas are mostly 50 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is clay. It is dark grayish brown to a depth of about 31 inches and gray to a depth of about 54 inches. The underlying material is gray and yellowish brown clay to a depth of more than 72 inches.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is strongly acid to slightly acid. Permeability is very slow, and the available water capacity is high. This soil has poor tilth. The root zone is difficult to penetrate by plant roots because of high clay content. A perched high water table is at a depth of 0.5 foot to 1.5 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Dennis, Okemah, and Taloka soils. The included soils make up about 10 percent of the map unit, but areas of these soils are less than 5 acres.

This soil has low potential for row crops and small grains. Erosion is a severe hazard if cultivated crops are grown. Management practices are needed that improve soil structure and reduce surface crusting and erosion. Crops that produce large amounts of residue need to be grown in the cropping system. Returning crop residue to the soil improves soil structure, increases water intake, and reduces crusting and erosion. Terraces and contour tillage also help to control erosion. If fertilizer is used and crop residue is returned to the soil, sown crops can be grown without terracing.

This soil has medium potential for native grasses and tame pasture. Bermudagrass or tall fescue in combination with clovers is used mostly for tame pasture on this soil. Proper pasture management, which includes fertilization, is needed to maintain production of the grasses and clovers. The quality and quantity of all forage can be improved by using proper stocking and grazing, preventing wildfires, and controlling weeds.

This soil has low potential for most urban uses. Shrinking and swelling, wetness, and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields. Sewage lagoons can be used.

This Parsons soil is in capability subclass IVe and in the Claypan Prairie range site.

55—Parsons-Carytown silt loams, 0 to 1 percent slopes. This map unit consists of Parsons and Carytown soils on smooth, slightly convex slopes on uplands. These soils are deep, somewhat poorly drained or poorly drained, and nearly level. They have a perched high water table during winter and spring. Carytown and Parsons soils are so intricately mixed on the landscape that mapping them separately is not practical. The areas of these soils are mostly 40 to 200 acres, but individual areas of each soil are 5 acres or less.

Parsons soil makes up about 70 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer, to a depth of about 11 inches, is grayish brown silt loam. The subsoil extends to a depth of about 62 inches. It is dark grayish brown silty clay to a depth of about 21 inches, dark grayish brown clay to a depth of about 37 inches, and grayish brown clay below that.

The Parsons soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Permeability is very slow, and the available water capacity is high. A perched high water table is at a depth of 6 to 8 inches during winter and spring. The soil has fair tilth and can be worked within a medium range of moisture content.

Carytown soil makes up about 20 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is clay. It extends to a depth of about 62 inches. It is very dark grayish brown to a depth of about 22 inches, dark grayish brown to a depth of about 32 inches, and brown below that.

The Carytown soil is low in natural fertility, and the organic matter content is low to moderate. The surface layer is strongly acid to neutral. The subsoil has exchangeable sodium of 15 percent or more. Permeability is very slow, and the available water capacity is moderate. A perched high water table is at a depth of 1 foot or less during winter and spring. The surface soil crusts easily. Plant roots do not easily penetrate the subsoil.

Included with these soils in mapping are small areas of the Dennis and Taloka soils. Dennis soils are moderately well drained and are in higher positions than the Parsons and Carytown soils. The Taloka soils are somewhat poorly drained and are intermingled on the same landscape. The included soils make up about 10 percent of the map unit, but areas of these soils are 3 acres or less.

The Parsons and Carytown soils are used mainly for wheat, grain sorghum, and soybeans. A sizable acreage is in tame pasture plants.

These soils have medium potential for most cultivated crops. The main concerns in management are wetness, intake of water, and soil tilth and fertility. A good cropping system that includes proper residue management is beneficial to the soil. Fertilizing increases crop production. The increased crop residue maintains or improves soil fertility, soil tilth, and water intake. Proper row direction helps surface drainage in wet areas, which increases crop production and amounts of residue. Manure and chemical amendments, such as gypsum,

improve soil structure and intake of water on the Carytown silt loam. Excessive tillage needs to be avoided.

These soils have medium potential for native grasses and tame pasture. Tame pasture should include salt-tolerant grasses. Fertilizing and adding chemical amendments increase forage production. The additional plant growth helps control erosion. Proper grazing, preventing wildfires, and controlling weeds increase the quality and quantity of all forage.

The soils in this map unit have low potential for most urban uses because of wetness. Shrinking and swelling is a limitation for dwellings, small commercial buildings, and roads and streets.

These soils are in capability subclass IIIs. The Parsons soil is in the Claypan Prairie range site, and the Carytown soil is in the Shallow Claypan range site.

56—Pits. Pits are open excavations that are 5 to 100 feet deep, 200 to 1,000 feet long, and 150 to 500 feet wide. They have nearly vertical sides and a very gently sloping to sloping bottom. The material in the excavations is limestone, shale, and sandstone in upland areas and sand, loamy fine sand, loam, and sandy clay loam in areas along stream terraces. Soil, shale, sandstone, and limestone have been excavated for roads, dams, foundations, and similar structures. Pits are in areas of Bates, Coweta, Enders, Hector, Glenpool, Kamie, and Shidler soils.

Areas of this map unit are limited for agricultural or urban use. They support little to moderate amounts of vegetation and can be lightly grazed or used as habitat for wildlife.

The main concerns in management are grading and smoothing steeps slopes, controlling erosion, and maintaining tilth and fertility. Establishing, improving, and maintaining plant cover, controlling grazing, and fertilizing are needed in places. Some of the excavations contain water.

Pits are in capability subclass VIIs. They are not assigned to a range site.

57—Roebuck clay, rarely flooded. This soil is deep and somewhat poorly drained. It is on flood plains. Slopes are plane to slightly concave and are less than 1 percent. Individual areas are mostly 50 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown clay about 16 inches thick. The subsoil, to a depth of about 54 inches, is dark reddish brown and reddish brown silty clay. The underlying material is reddish brown silty clay to a depth of about 65 inches.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is slightly acid to mildly alkaline. Permeability is very slow, and the available water capacity is high. This soil has poor tilth. The root zone is hard to penetrate by plant roots because of the high clay content.

Included with this soil in mapping are Keo, Latanier, Roxana, and Severn soils on slightly higher flood plains. The included soils make up about 10 percent of the map unit, but areas of these soils generally are less than 5 acres.

This soil is mainly used for cultivated crops. It has medium potential for row crops and small grains. The main concerns in management are surface wetness, slow water intake, and soil tilth. Most crops can be grown continuously if the soil has been fertilized to produce maximum crop residue. Large amounts of residue help maintain organic matter and contribute to good soil tilth and intake of water. If this soil is wet, tillage or grazing breaks down soil structure and reduces water intake. Proper row arrangement for drainage reduces surface wetness and allows for better crop growth.

This soil has high potential for native grasses and tame pasture. A combination of bermudagrass or tall fescue and clover is commonly used for tame pasture. The main concerns in management are flooding and maintenance of soil structure. Growth of tame pasture plants can be increased by adding fertilizer and using proper grazing. A good grass mulch helps to maintain soil structure, improve water intake, and protect the soil from erosion during flooding.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. The main concerns in areas used for septic tank absorption fields, sanitary landfills, dwellings, and local roads and streets are shrinking and swelling, flooding, the clayey surface layer, and very slow permeability.

This Roebuck soil in in capability subclass IIIw and in the Heavy Bottomland range site.

58—Roebuck clay, occasionally flooded. This soil is deep, somewhat poorly drained, and nearly level. It is on flood plains. Slopes are plane to slightly concave and are less than 1 percent. Individual areas are mostly 50 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown and very dark grayish brown clay about 22 inches thick. The subsoil, to a depth of about 53 inches, is dark reddish brown silty clay. The underlying material is reddish brown silty clay to a depth of about 70 inches.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is slightly acid to mildly alkaline. Permeability is very slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The

root zone is hard to penetrate because of the high clay content.

Included with this soil in mapping are the Latanier, Severn, and Verdigris soils in higher positions. Also included are a few small ponded areas in lower concave positions. The included soils make up about 15 percent of the map unit, but areas of these soils generally are less than 5 acres.

This soil is mainly used for cultivated crops. It has medium potential for row crops and small grains. The main concerns in management are flooding, surface wetness, slow water intake, and soil tilth. Close-growing crops are needed late in fall and in winter and spring to prevent excessive loss of soil during flooding (fig. 9). The planting of spring crops needs to be delayed until after the common flood periods. Most crops can be grown continuously if the soil has been fertilized to produce maximum crop residue. Large amounts of residue help maintain the organic matter content and contribute to good soil tilth and intake of water. If this soil is wet, tillage or grazing breaks down soil structure and reduces water intake. Proper row arrangement for drainage reduces surface wetness and allows for better crop growth.

This soil has high potential for native grasses and tame pasture. A combination of bermudagrass or fescue and clover is commonly used for hay and pasture. The main concerns in management include controlling grazing and preventing wildfires. Fertilizing increases

Figure 9.—A close-growing crop is needed in this area of Roebuck clay, occasionally flooded, to control erosion during flooding.

forage production; the additional plant growth helps control erosion during flooding.

Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. Flooding is the main concern in areas used for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, and local roads and streets.

This Roebuck soil is in capability subclass IIIw and in the Heavy Bottomland range site.

59—Roebuck clay, frequently flooded. This soil is deep and somewhat poorly drained. It is on flood plains. Slopes are plain to concave and generally are less than 1 percent. Individual areas are mostly 30 to 100 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown clay about 5 inches thick. The subsoil extends to a depth of 49 inches. It is dark reddish brown clay to a depth of about 25 inches, dark reddish brown silty clay loam to a depth of about 31 inches, and dark brown silty clay below that. The underlying material to a depth of about 67 inches is dark reddish brown silty clay.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is slightly acid to mildly alkaline. Permeability is very slow, and the available water capacity is high.

Included with this soil in mapping are Latanier, Severn, and Verdigris soils on higher elevations. Also included are a few small ponded areas in lower positions than those of the Roebuck soil. The included soils make up about 10 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Roebuck soil is mainly used for native range. In a few areas, it is used for tame pasture plants or as forests of elm, oak, hickory, and pecan.

This soil has low potential for small grains and row crops. The main concern in management is the frequent flooding.

This soil produces high-quality hardwoods where the trees are thinned, weeded, and selectively harvested. Brush control is needed to obtain high yields.

Potential is high for native grasses and medium for tame pasture. A combination of bermudagrass or tall fescue and clover is commonly used for tame pasture. The main concerns in management are flooding and maintenance of soil structure. Growth of tame pasture plants can be increased by fertilizing and proper grazing. A good grass mulch helps to maintain soil structure, improve water intake, and protect the soil from erosion during flooding.

This soil has low potential for most urban uses. Flooding is the main concern in areas used for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, and local roads and streets.

This Roebuck soil is in capability subclass Vw and in the Heavy Bottomland range site.

60—Roxana very fine sandy loam, rarely flooded, 0 to 1 percent slopes. This soil is deep, well drained, and nearly level. It is on flood plains of the Arkansas River. Slopes are smooth. Individual areas are irregular in shape and range mostly from 40 to 300 acres, but some areas are about 5 acres.

Typically, the surface layer is brown very fine sandy loam about 7 inches thick. The underlying material is reddish brown very fine sandy loam to a depth of at least 60 inches.

This soil is high in natural fertility, and the organic matter content is low to moderate. Reaction is slightly acid to mildly alkaline in the surface layer. Permeability is moderate, surface runoff is slow, and the available water capacity is moderate to high. The surface layer is very friable and easily tilled throughout a wide range of moisture content. Root development is unrestricted throughout the soil.

Included with this soil in mapping are small intermingled areas of Keo, Norwood, and Severn soils. The included soils make up about 10 percent of the map unit, but areas of these soils are less than 3 acres.

This Roxana soil is mainly used for cultivated crops. In some areas, it is used for tame pasture plants or as woodland.

This soil has high potential for cultivated crops of soybeans, alfalfa, wheat, corn, and grain sorghum. Erosion is a slight hazard. Conservation tillage and cover crops prevent soil loss. Crop residue returned to the soil reduces crusting and improves fertility and water infiltration.

This soil has high potential for native grasses and tame pasture and hay. It is suited to bermudagrass and other grasses and legumes. Use of this soil as pastureland or hayland is effective in controlling erosion. Fertilization and proper pasture management increase the amount of forage and improve the quality.

This soil has high potential for growing trees for windbreaks and environmental plantings.

This soil has low potential for most urban uses. Although floods are not probable, the possibility imposes limitations on urban uses. Onsite investigation is needed to evaluate and plan for urban development.

This Roxana soil is in capability class I and in the Loamy Bottomland range site.

61—Roxana very fine sandy loam, rarely flooded, 1 to 3 percent slopes. This soil is deep, well drained, and very gently sloping. It is on flood plains of the Arkansas River. Slopes are smooth and slightly undulating. Individual areas are generally long and narrow and range

mostly from 30 to 150 acres, but some areas are about 10 acres.

Typically, the surface layer is brown very fine sandy loam about 9 inches thick. The underlying material to a depth of at least 60 inches is reddish brown very fine sandy loam that has thin, finer strata.

This soil is high in natural fertility, and the organic matter content is low to moderate. Reaction is slightly acid to mildly alkaline in the surface layer. Permeability is moderate, and surface runoff is slow. The available water capacity is moderate to high. The surface layer is very friable and easily tilled throughout a wide range of moisture content. Root development is unrestricted throughout the soil.

Included with this soil in mapping are small intermingled areas of Keo and Severn soils. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Roxana soil is used mainly for cultivated crops and has high potential for this use. It is suited to soybeans, alfalfa, wheat, corn, and grain sorghum. Erosion is a moderate hazard. Conservation tillage, cover crops, terraces, waterways, and contour farming prevent soil losses. Returning crop residue to the soil improves fertility and water infiltration and reduces crusting.

This soil has high potential for native grasses and tame pasture. It is suited to alfalfa, bermudagrass, and other grasses and legumes. Use of this soil as pastureland or hayland is effective in controlling erosion. Proper pasture management and fertilization are needed to improve the quality and increase the amount of forage.

This soil has high potential for growing trees for windbreaks and environmental plantings.

This soil has low potential for most urban uses. Although floods are not probable, the possibility imposes limitations on urban uses. Onsite investigation is needed to evaluate and plan for urban development.

This Roxana soil is in capability subclass IIe and in the Loamy Bottomland range site.

62—Severn very fine sandy loam, rarely flooded, 0 to 1 percent slopes. This soil is deep, nearly level, and well drained. Permeability is moderately rapid. This soil is on broad, smooth flood plains. Individual areas are 15 to 175 acres, but some areas are about 10 acres.

Typically, the surface layer is reddish brown very fine sandy loam about 8 inches thick. The underlying material is reddish brown very fine sandy loam to a depth of about 60 inches.

This soil is high in natural fertility, and the organic matter content is low. The surface layer is mildly alkaline or moderately alkaline. The available water capacity in the upper 40 inches is moderate or high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are areas of soils similar to the Severn soil except they have more than 15 percent sand coarser than very fine sand within the control section. Also included are areas of Norwood and Roxana soils. The included soils make up about 20 percent of the map unit, but areas of these soils are less than 5 acres.

Severn soil is used mostly for soybeans, alfalfa, vegetable crops, and small grains. In a few areas, it is used for cottonwood, pecan, and hackberry. In other areas, this soil is used as habitat for wildlife.

This soil has high potential for cultivated crops. Good soil management is needed to maintain soil tilth and fertility. Most crops that produce large amounts of residue can be grown continuously where the soil is well managed and the crop residue is returned to the soil. Fertilizing helps to maintain good tilth and fertility. Conservation tillage is needed.

This soil has high potential for use as woodland. Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

The Severn soil has high potential for native grasses and tame pasture plants. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and preventing wildfires. Fertilizer can increase growth of tame pasture plants.

This soil has low potential for most urban uses. Seepage is a limitation for sewage lagoons and sanitary landfills. Rare flooding limits the use of this soil as sites for dwellings and small commercial buildings.

This Severn soil is in capability class I and in the Loamy Bottomland range site.

63—Severn very fine sandy loam, rarely flooded, 2 to 6 percent slopes. This soil is deep, very gently sloping to moderately sloping, and well drained. It is on flood plains on smooth, slightly convex side slopes between different terrace levels. Individual areas are generally long and narrow. They range mostly from 30 to 90 acres, but some areas are about 10 acres.

Typically, the surface layer is reddish brown very fine sandy loam about 10 inches thick. The underlying material is reddish brown very fine sandy loam to a depth of about 60 inches.

This soil is high in natural fertility, and the organic matter content is low. The surface layer is moderately alkaline. Permeability is moderately rapid, and the available water capacity in the upper 40 inches is moderate or high. This soil has good tilth and can be worked throughout a wide range of moisture content.

Included with this soil in mapping are intermingled areas of Roxana soils and soils similar to the Severn soil except they have more than 15 percent sand coarser than very fine sand between depths of 10 and 40 inches.

The included soils make up about 20 percent of this map unit, but areas of these soils generally are less than 3 acres.

Severn soil is used mostly for soybeans, alfalfa, vegetable crops, and small grains. A few areas are in cottonwood, pecan, and hackberry. In other areas, this soil is used as habitat for wildlife.

This soil has high potential for cultivated crops, but soil management is needed to maintain tilth and fertility. Most crops that produce large amounts of residue can be grown continuously if the soil is well managed and most of the crop residue is returned to the soil. Fertilizing helps to maintain organic matter content, good tilth, and fertility. Conservation tillage is needed.

This soil has high potential for woodland. Wooded areas can be maintained or improved by removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule.

The Severn soil has high potential for native grasses and tame pasture. The quality and quantity of forage can be maintained or improved by controlling brush, using suitable grazing practices, and protecting from wildfires. Fertilizers increase growth of tame pasture plants.

This soil has low potential for most urban uses. Because of the permeability, seepage is a limitation for sewage lagoons and sanitary landfills. Rare flooding limits the use of this soil as sites for dwellings and small commercial buildings.

This Severn soil is in capability subclass IIIe and in the Loamy Bottomland range site.

64—Shermore loam, 3 to 5 percent slopes. This soil is deep, moderately well drained, and gently sloping. It is on foot slopes adjacent to the mountains and ridges. Slopes are smooth and slightly convex. Individual areas are mostly 25 to 160 acres, but some areas are about 5 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsurface layer is brown loam to a depth of about 12 inches. The subsoil extends to a depth of about 65 inches. It is yellowish brown clay loam to a depth of about 31 inches; coarsely mottled brown, yellowish brown, and dark gray, brittle clay loam to a depth of about 50 inches; and brownish yellow, brittle sandy clay loam below that.

This soil is medium in natural fertility, and the organic matter content is low to moderate. The surface layer is strongly acid or medium acid. Permeability is moderately slow, and the available water capacity is moderate. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots. A perched high water table is at a depth of 1.5 to 3.5 feet during winter and spring.

Included with this soil in mapping are small areas of Enders, Endsaw, and Linker soils. The Enders and Endsaw soils are on high slopes, and the Linker soils are in lower areas adjacent to the Shermore soil. The included soils make up about 15 percent of this map unit, but areas of these soils are less than 5 acres.

This Shermore soil is mainly used as pasture. In some areas, it is used as woodland.

This soil has low potential for row crops and medium potential for small grains. Good tilth can be maintained by returning crop residue to the soil. Erosion is a severe hazard if cultivated crops are grown. Conservation tillage, cover crops, terraces, and contour tillage reduce runoff and help to control erosion. Row crops need to be avoided.

This soil has medium potential for native grasses and tame pasture. Bermudagrass, tall fescue, and weeping lovegrass are the common tame pasture plants. Fertilizing tame pasture improves the quality of grass and increases forage production. The additional plant growth protects the soil from erosion. The quality and quantity of forage can be maintained or improved by using suitable grazing practices and by protecting against damage by wildfires.

This soil has low potential for most urban uses. Wetness is the main limitation for septic tank absorption fields, sanitary landfills, roads and streets, dwellings, and small commercial buildings.

This Shermore soil is in capability subclass IIIe and in the Sandy Savannah range site.

65—Shidler-Rock outcrop complex, 5 to 30 percent slopes. This complex consists of the Shidler soil and Rock outcrop on sloping to steep uplands mainly in the northeastern part of the county. The Shidler soil is very shallow and shallow and well drained. This soil and Rock outcrop are so intermingled that they can not be shown separately at the scale selected for mapping. Slopes are long and convex. Sloping to strongly sloping benches are just above Rock outcrop escarpments, and moderately steep to steep slopes are below the escarpments. Individual areas range from 40 to 300 acres.

The Shidler soil makes up about 55 percent of the complex. Typically, the surface layer is very dark grayish brown stony silty clay loam about 7 inches thick. The underlying material is hard, fractured, gray limestone.

The Shidler soil is high in natural fertility, and the organic matter content is moderate to high. This soil is slightly acid to moderately alkaline throughout. Permeability is moderate, and the available water capacity is moderate to high. The root zone is very shallow or shallow, and root growth is restricted by the limestone bedrock.

Rock outcrop makes up about 20 percent of the complex. It consists of exposed bare, hard, grayish limestone bedrock. Rock outcrop supports very few plants, and it has very rapid surface runoff.

Included with this complex in mapping are intermingled areas of Enders, Endsaw, Hector, and Linker soils. Also

included are small areas of Oktaha, Shermore, and Spiro soils. These included soils make up about 25 percent of the map unit, but areas of these soils are generally less than 5 acres.

The Shidler soil is used mainly for native grasses for grazing beef cattle.

This soil has low potential for native grasses, but it is best suited to this use. Low to moderate forage yields can be expected with proper management. The quality and quantity of native grasses can be improved by controlling brush, proper stocking, controlling grazing, and preventing wildfires.

This soil has low potential for crops, tame pasture, and most urban uses. Depth to bedrock and outcrop of limestone are severe limitations that are difficult and expensive to overcome.

The Shidler soil is in capability subclass VIIs, and Rock outcrop is in capability subclass VIIIs. Shidler soil is in the Very Shallow range site. Rock outcrop is not assigned to a range site.

66—Spiro silt loam, 1 to 3 percent slopes. This soil is moderately deep, well drained, and very gently sloping. It is on uplands in the eastern part of the county. Slopes are smooth and slightly convex. Individual areas are mainly 25 to 50 acres, but some areas are about 5 acres.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 36 inches. It is brown silt loam to a depth of about 12 inches and brown silty clay loam below that. Fragments of sandstone and siltstone are at a depth of 32 to 36 inches. The underlying material is light yellowish brown siltstone and shale.

This soil is high in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. A perched high water table is at a depth of 3 to 4 feet during winter and spring.

Included with this soil in mapping are intermingled areas of Hector, Linker, and Oktaha soils. The included soils make up about 20 percent of the map unit, but areas of these soils are less than 5 acres.

Spiro soil is used mostly as range and tame pasture. It is also used for grain sorghum, small grains, and soybeans.

This soil has high potential for small grains and row crops. Management is needed to maintain fertility and soil structure and reduce erosion. Terracing, contour farming, stripcropping, and returning crop residue to the soil can reduce erosion. Sown crops can be grown year after year if fertilizer is added and crop residue is returned to the soil. Excessive tillage needs to be avoided.

This soil has high potential for native grasses and tame pasture. Bermudagrass and clover is the most common mixture used for tame pasture. Fertilizing tame pasture grasses improves the quality and quantity of forage, which helps protect the soil from erosion. The quality of all grasses can be maintained or improved by preventing wildfires and by controlling grazing.

This soil has medium potential for most urban uses. Depth to bedrock is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area. Depth to bedrock is also the main limitation for sewage lagoons, dwellings with basements, and sanitary landfills.

This Spiro soil is in capability subclass IIe and in the Loamy Prairie range site.

67—Stigler silt loam, 0 to 1 percent slopes. This soil is deep, nearly level, and moderately well drained. It is on broad, smooth uplands in prairie areas. Individual areas range mostly from 30 to 100 acres, but some areas are about 10 acres.

Typically, the surface layer is grayish brown silt loam about 15 inches thick. The subsurface layer to a depth of about 26 inches is light brownish gray silt loam. The subsoil extends to a depth of about 80 inches. It is brown silty clay to a depth of about 40 inches and coarsely mottled strong brown, pale brown, and grayish brown clay to a depth of about 64 inches. Below that, the subsoil is gray clay that has strong brown mottles.

This soil is medium in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is very strongly acid or strongly acid. Lime and plant food are needed for nearly all crops. Permeability is very slow, and the available water capacity is high. This soil has fair tilth and can be worked throughout a medium range of moisture content. A perched high water table is between depths of 2 and 3 feet in winter and early in spring.

Included with this soil in mapping are Dennis and Taloka soils. Dennis soils are in higher positions than Stigler soil, and Taloka soils are on the same landscape. The included soils make up about 15 percent of this map unit, but areas of these soils generally are less than 3 acres.

Stigler soil is used principally as tame pasture or range, but in some areas, it is used for small grains, corn, cotton, or soybeans.

This soil has high potential for cultivated crops. It has a very slow intake of water and is often wet when it is time to plant or harvest field crops. Crop residue returned to the soil improves soil structure and water intake. Surface drainage is needed on soil in slight depressions.

This soil has medium potential for native grasses and high potential for tame pasture. A combination of bermudagrass or tall fescue and clover is commonly used. Controlling weeds, proper grazing, and preventing

wildfires improve the quality and quantity of forage. Fertilizer also increases the quantity of forage.

This soil has low potential for most urban uses because of very slow permeability, wetness, shrink-swell potential, and the clayey texture. The soil wetness and high shrink-swell potential must be considered where this soil is used for dwellings, commercial buildings, and roads or streets. The acidity of this soil corrodes concrete or steel pipe. Permeability and the clayey texture of this soil are the main limitations for septic tank filter fields and sanitary landfills.

This Stigler soil is in capability subclass IIw and in the Loamy Savannah range site.

68—Stigler silt loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and moderately well drained. It is on broad, smooth uplands in prairie areas. Individual areas are mostly 30 to 100 acres, but some areas are about 10 acres.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface layer to a depth of about 23 inches is grayish brown silt loam. The subsoil extends to a depth of about 80 inches. It is brown silty clay to a depth of about 38 inches and coarsely mottled yellowish brown and gray silty clay loam to a depth of about 72 inches. It is coarsely mottled yellowish brown and light brownish gray silty clay loam below that.

This soil is low in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is very strongly acid or strongly acid. Lime and plant food are needed for nearly all crops. Permeability is very slow, and the available water capacity is high. This soil has fair tilth and can be worked throughout a medium range of moisture content. A perched high water table is between depths of 2 and 3 feet in winter and early in spring.

Included with this soil in mapping are intermingled areas of Dennis and Taloka soils. Dennis soils have a loamy surface layer that is less than 20 inches thick. Taloka soils are on the same landscape as the Stigler soil.

This Stigler soil is used principally as tame pasture or range, but in some areas, it is used for small grains, corn, cotton, or soybeans (fig. 10).

This soil has high potential for cultivated crops. Management is needed to maintain or improve fertility and soil structure and reduce erosion. Plant cover is needed during winter and spring to protect the soil from erosion. Sown crops can be grown year after year if fertilizer is added and crop residue is returned to the soil. Terracing and contour farming are needed, especially where row crops are grown. If this soil is used for row

Figure 10.—Stigler silt loam, 1 to 3 percent slopes, is used mainly as pasture or range, but it is well suited to use for such row crops as soybeans.

crops, the crop residue needs to be returned to the soil and excessive tillage should be avoided.

This soil has medium potential for native grasses and high potential for tame pasture. A combination of bermudagrass or tall fescue and clover is commonly used. Controlling weeds, proper grazing, and preventing wildfires improve the quality and quantity of forage. Fertilizer can also increase the quantity of forage.

This soil has low potential for most urban uses because of permeability, wetness, high shrink-swell potential, and the clayey texture. Low strength, wetness, texture, and shrink-swell potential must be considered where this soil is used for dwellings, commercial buildings, and roads or streets. The acidity of this soil is corrosive for concrete or steel pipe. This soil has limitations for septic tank filter fields and sanitary landfills.

This Stigler soil is in capability subclass IIe and in the Loamy Savannah range site.

69—Stigler-Urban land complex, 0 to 3 percent slopes. This complex consists of Stigler soil and Urban land on smooth or slightly convex uplands. The Stigler soil is nearly level to very gently sloping and moderately well drained. Most areas of this map unit are drained by surface gutters and ditches. Individual areas of this map unit range from 30 to 300 acres and contain 40 to 60 percent Stigler soil and 20 to 40 percent Urban land. The Stigler soil and Urban land are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Stigler soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsurface layer is grayish brown silt loam about 10 inches thick. The subsoil extends to a depth of about 62 inches. It is brown silty clay to a depth of 40 inches and coarsely mottled yellowish brown and grayish brown silty clay below that. In about 20 to 30 percent of the area of this map unit, the soils have been radically altered by excavating, filling, and grading during construction.

The Stigler soil is medium in natural fertility, and the organic matter content is moderate to moderately high. Fertilizer is needed for most plants. Reaction in the surface layer is very strongly acid or strongly acid unless lime has been added. Permeability is very slow, and the available water capacity is high. The soil is tillable and can be worked throughout a wide range of moisture content. A perched high water table is at a depth of 2 to 3 feet during winter and spring.

The Urban land part of this map unit is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with this complex in mapping are small areas of Dennis and Parsons soils. Parsons soils are in positions similar to those of the Stigler soil and are somewhat poorly drained. Dennis soils are on the more convex slopes and are moderately well drained. The included soils make up about 20 percent of the map unit, but areas of these soils are generally less than 10 acres.

The Stigler soil is used for parks, building sites, gardens, trees, and shrubs. It is also used for industry and recreation.

The main concerns in management of this soil are the very slow permeability, wetness, high shrink-swell potential, and high corrosivity. The Stigler soil is well suited to use for lawn grasses, flowers, shrubs, trees, and most vegetables. It has slight limitations for sewage lagoons and severe limitations for septic tank absorption fields, sanitary landfills, dwellings, commercial buildings, camp areas, playgrounds, and roads and streets mainly because of wetness and high shrink-swell potential of the clayey subsoil. The clayey subsoil and low acidity of the subsoil cause high corrosivity of uncoated steel and concrete.

This complex soil is not assigned a capability subclass or a range site.

70—Taloka silt loam, 0 to 1 percent slopes. This soil is deep, nearly level, and somewhat poorly drained. It is on broad, smooth, stream terraces or uplands in prairie areas. Individual areas are mostly 30 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is very dark grayish brown silt loam about 16 inches thick. The subsurface layer, to a depth of about 24 inches, is grayish brown silt loam. The subsoil is clay to a depth of about 65 inches. It is dark grayish brown to a depth of about 36 inches, grayish brown to a depth of about 48 inches, and coarsely mottled yellowish brown, grayish brown, and gray below that.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid, and lime and plant foods should be added for most crops. Permeability is very slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a moderate range of moisture content. A perched high water table is between depths of 1 foot and 2 feet during winter and spring.

Included with this soil in mapping are intermingled areas of soils similar to the Taloka soil but they have a lighter color subsurface layer. Also included are Dennis, Parsons, and Stigler soils. The included soils make up about 20 percent of the map unit, but areas of these soils generally are less than 5 acres.

Taloka soil is used mainly for small grains, sorghums, and soybeans. In a few areas, it is used for tame pasture or for native range or hayland.

This soil has high potential for cultivated crops. The main concerns in management are controlling soil erosion and maintaining soil fertility and tilth. Crop residue returned to the soil and conservation tillage help maintain soil fertility and tilth and increase water intake. In a few areas that have long slopes, contour farming with diversion terraces helps control erosion. A drainage

system and proper row arrangement for drainage reduce surface wetness and improve crop production. Cover crops in the winter reduce erosion and improve organic matter and soil tilth.

This soil has high potential for native grasses and tame pasture. Bermudagrass and clover are the most commonly used pasture plants. Controlling weeds, proper grazing, and preventing wildfires improve the quality and quantity of forage.

This soil has low potential for most urban uses because of wetness, the clay texture, and high shrink-swell potential. The main soil features to consider when this soil is to be used for dwellings, commercial buildings, or roads and streets are the shrink-swell potential, soil strength, and wetness. Soil reaction should be considered if steel or concrete pipes are used. Wetness, permeability, and the clayey texture are limitations for septic tank filter fields, sewage lagoons, and sanitary landfills.

This Taloka soil is in capability subclass IIw and in the Loamy Prairie range site.

71—Taloka silt loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and somewhat poorly drained. It is on broad, smooth stream terraces and uplands in prairie areas in the western part of the county. Individual areas are mostly 30 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is very dark grayish brown silt loam about 13 inches thick. The subsurface layer, to a depth of about 20 inches, is grayish brown silt loam. The subsoil extends to a depth of about 63 inches. It is dark yellowish brown clay to a depth of about 35 inches and coarsely mottled brown, yellowish brown, and gray silty clay below that.

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Lime and plant foods should be added for most crops. Permeability is very slow, and the available water capacity is high. This soil has good tilth and can be worked throughout a moderate range of moisture content. A perched high water table is between depths of 1 foot and 2 feet during winter and spring.

Included with this soil in mapping are intermingled areas of soils similar to the Taloka soil except they have a lighter color subsurface layer. Also included are Parsons and Dennis soils. The included soils make up about 24 percent of the map unit.

Taloka soil is used mainly for small grains, sorghums, and soybeans. In some small areas, it is used for tame pasture or for native range or hayland.

This soil has high potential for cultivated crops. The major concerns in management are controlling soil erosion and maintaining soil fertility and tilth. Terraces, contour tillage, conservation tillage, and return of crop residue to the soil help control erosion and maintain soil tilth and fertility. Keeping row crops to a minimum and planting small grains, pasture grasses, legumes, or native grasses in rotation with row crops also protect against erosion.

This soil has high potential for native grasses and tame pasture. A combination of bermudagrass or tall fescue and clover is commonly used for tame pasture. Controlling weeds, proper grazing, and preventing wildfires improve the quality and quantity of forage. Fertilizer also increases growth of tame pasture plants.

This soil has low potential for most urban uses because of wetness, permeability, soil texture, and high shrink-swell potential. The shrink-swell potential, soil strength, and wetness are limitations for dwellings, commercial buildings, and roads and streets. Soil reaction should be considered if steel or concrete pipes are used. Wetness, permeability, and the clayey texture are limitations for septic tank filter fields, sewage lagoons, or sanitary landfills.

This Taloka soil is in capability subclass IIe and in the Loamy Prairie range site.

72—Taloka-Urban land complex, 0 to 3 percent slopes. This complex consists of areas of Taloka soil and Urban land on smooth or slightly convex uplands. The Taloka soil is nearly level to very gently sloping and somewhat poorly drained. Most areas of this map unit are drained by surface gutters and ditches. Individual areas of this map unit range from 30 to 300 acres. This complex is 40 to 60 percent Taloka soil and 20 to 40 percent Urban land. The Taloka soil and Urban land are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Taloka soil has a surface layer of very dark grayish brown silt loam about 12 inches thick. The subsurface layer is grayish brown silt loam to a depth of about 22 inches. The subsoil is clay to a depth of about 70 inches. It is dark grayish brown to a depth of 45 inches and coarsely mottled yellowish brown and grayish brown below that. In about 30 percent of the area of this map unit, the soil has been radically altered by excavating, filling, and grading during construction.

The Taloka soil is medium in natural fertility, and the organic matter content is low. Fertilizer is needed for most plants. Reaction in the surface layer is strongly acid or medium acid unless lime has been added. Permeability is very slow, and the available water capacity is high. The Taloka soil is easily tilled and can be worked only within a moderate range of moisture content. A perched high water table is at a depth of 1 foot to 2 feet during winter and spring.

The Urban land part of this map unit is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with this complex in mapping are small areas of Dennis and Parsons soils. Parsons soils are in similar positions to those of the Taloka soil, and they are

somewhat poorly drained. The Dennis soils are on the more convex slopes and are moderately well drained. The included soils make up about 20 percent of the map unit, but areas of these soils generally are less than 10 acres.

The Taloka soil is used for parks, building sites, gardens, trees, and shrubs. It is also used for industry and recreation. The main concerns in management of this soil is very slow permeability, wetness, high shrink-swell potential, and high corrosivity.

The Taloka soil is suited to use for lawn grasses, flowers, shrubs, and most vegetables. Wetness is a severe limitation for septic tank absorption fields, sanitary landfills, dwellings, commercial buildings, camp areas, playgrounds, and roads and streets. High shrink-swell potential of the clayey subsoil is the main limitation for dwellings with basements. The clayey subsoil and low acidity of the subsoil cause high corrosivity of uncoated steel and moderate corrosivity of concrete.

This complex is not assigned to a capability subclass or a range site.

73—Tullahassee loamy fine sand, frequently flooded. This soil is deep, nearly level, and somewhat poorly drained. It is on flood plains, about 150 to 500 feet wide, that are entrenched with shallow, meandering stream channels. The smooth and slightly concave slopes range from 0 to 1 percent. Individual areas are mostly 50 to 200 acres, but some areas are about 10 acres.

Typically, the surface layer is dark brown loamy fine sand about 6 inches thick. The underlying material is dark brown fine sandy loam to a depth of about 21 inches. It is dark yellowish brown and grayish brown fine sandy loam and loam that is stratified with finer and coarser textures to a depth of about 65 inches.

This soil is low in natural fertility and organic matter content. It is neutral to medium acid in the surface layer. Permeability is moderately rapid, and the available water capacity is low to high. An apparent high water table is at a depth of 0.5 foot to 3 feet in the winter and spring. This soil is frequently flooded.

Included with this soil in mapping are Lightning and Verdigris soils. These soils are in slightly higher areas than the Tullahassee soil. Also included are soils similar to the Tullahassee soil except the surface layer is fine sandy loam or loam. The included soils make up about 20 percent of the map unit, but areas of these soils generally are less than 3 acres.

This Tullahassee soil is used mostly as tame pasture or woodland.

This soil has low potential for cultivated crops and is not suited to cultivation. The main concerns in management are frequent flooding and the high water table. This soil produces high-quality hardwoods where trees are thinned, weeded, and selectively harvested.

This soil has high potential for tame pasture and native range. A combination of bermudagrass or tall fescue and clover is commonly used. The main concerns in management are flooding and maintenance of soil structure. Growth of tame pasture plants can be increased by adding fertilizer to the soil and by proper grazing. A good grass mulch helps to maintain soil structure, improve water intake, and protect the soil from erosion during flooding.

This soil has low potential for most urban uses because of flooding and internal soil wetness. It is well suited to trees and shrubs. Flooding and surface wetness limit the use of this soil for lawn grasses, gardens, flowers, sanitary facilities, building site development, and recreation. Wetness can be reduced by internal drainage. Flooding can be controlled but not completely eliminated by upstream flood control structures.

This Tallahassee soil is in capability subclass Vw and in the Subirrigated range site.

74—Urban land. The areas designated as Urban land on soil maps are within the city boundary of Muskogee. Urban land is composed of areas that are more than 75 percent covered with dwellings, commercial buildings, concrete, paved roads, airport runways, and other structures. Slopes are 0 to 8 percent, and the individual areas are more than 40 acres.

Included in mapping are soils that are less than 75 percent covered with permanent structures. Areas of these included soils are less than 3 acres.

Urban land is not assigned to a capability subclass or range site.

75—Verdigris silt loam, rarely flooded. This soil is deep, moderately well drained, and nearly level. It is on local flood plains in the western half of the county. Slopes are smooth and range from 0 to 1 percent. Individual areas mostly are 25 to 50 acres, but some areas are about 5 acres.

Typically, the surface layer is very dark grayish brown silt loam about 18 inches thick. Below the surface and to a depth of about 43 inches is dark brown silt loam. The underlying material is dark yellowish brown silt loam to a depth of about 69 inches.

This soil is high in natural fertility, and the organic matter content is moderately high. The surface layer is medium acid to neutral. Permeability is moderate, and the available water capacity is high. The soil has good tilth but can only be worked under favorable moisture content. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are intermingled areas of Cupco and Barge soils. Also included are Lightning, Osage, Roebuck, and Tullahassee soils in slightly lower areas than Verdigris soil. The included soils

make up about 15 percent of the map unit, but areas of these soils generally are less than 5 acres.

This Verdiris soil is mostly used for grain sorghum, soybeans, and small grains. In some areas, it is used for tame pasture or for forests of elm, oak, hickory, and pecan.

This soil has high potential for most cultivated crops. The main concerns in management are controlling rare flooding and maintaining tilth. Most crops that produce a large amount of residue can be grown continuously if fertilizer is applied. The additional plant growth can provide maximum crop residue. Maintaining the organic matter content of this soil improves tilth and intake of water. Conservation tillage is needed.

This soil has high potential for tame pasture and native grasses. A combination of bermudagrass or tall fescue and clover is the commonly used tame pasture. The main concerns in management are soil tilth, soil fertility, and water intake. Growth of tame pasture plants can be increased by adding fertilizer to the soil and by controlling grazing.

This soil has low potential for all urban uses. Flooding limits the use of the soil for dwellings, small commercial buildings, roads and streets, and all sanitary facilities except sewage lagoons. The hazard of flooding can be reduced but not completely eliminated by upstream flood control.

This Verdigris soil is in capability class I and in the Loamy Bottomland range site.

76—Verdigris silt loam, occasionally flooded. This soil is deep, moderately well drained, and nearly level. It is on flood plains. Slopes are smooth and range from 0 to 1 percent. Individual areas are mostly from 15 to 100 acres, but some areas are 5 acres.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. Below the surface and to a depth of about 31 inches is dark brown silt loam. The underlying material is dark yellowish brown silt loam to a depth of more than 60 inches.

This soil is high in natural fertility, and the organic matter content is moderately high. The surface layer is medium acid to neutral. Permeability is moderate, and the available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots. Occasionally, surface water is ponded for short periods after flooding.

Included with this soil in mapping are intermingled areas of Lightning and Verdigris soils that are subject to frequent flooding. The included soils make up about 10 to 15 percent of the map unit, but areas of these soils generally are less than 3 acres.

This Verdigris soil is used mainly for small grains, grain sorghum, and wheat. In a few areas, it is used as tame pasture or native woodlands.

This soil has high potential for row crops and small grains. The main concerns in management are controlling occasional flooding and maintaining tilth. Close-growing crops are needed late in fall and in winter and spring to prevent excessive erosion during flooding. Planting in spring is delayed until after the period of flooding. Most crops that produce a large amount of residue can be grown continuously if fertilizer is applied. The additional plant growth can provide maximum crop residue. Maintaining the organic matter content of this soil improves tilth and intake of water. Conservation tillage is needed.

This soil has high potential for tame pasture and native grasses. A combination of bermudagrass or tall fescue and clover is the commonly used tame pasture. The main concerns in management are soil tilth, soil fertility, and water intake. Growth of tame pasture plants can be increased by adding fertilizer to the soil and by controlling grazing.

This soil has low potential for most urban uses because of flooding. The low strength and occasional flooding limit the use of the soil as sites for dwellings, small commercial buildings, and roads and streets. The low strength can be overcome by good design and careful installation. Flooding and permeability also limit the use for sewage lagoons.

This Verdigris soil is in capability subclass IIw and in the Loamy Bottomland range site.

77—Verdigris silt loam, frequently flooded. This soil is deep, moderately well drained, and nearly level. It is on local flood plains in the western part of the county. Slopes are smooth or slightly undulating and range from 0 to 1 percent. Individual areas are mostly 25 to 50 acres, but some areas are about 5 acres.

Typically, the surface layer is dark grayish brown silt loam about 24 inches thick. Below the surface and to a depth of about 46 inches is brown loam. The underlying material is dark brown loam to a depth of about 54 inches and dark yellowish brown loam to a depth of about 76 inches.

This soil is high in natural fertility, and the organic matter content is moderately high. The surface layer is medium acid to neutral. Permeability is moderate, and the available water capacity is high. The soil has good tilth but can only be worked under favorable moisture content. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are intermingled areas of Cupco and Barge soils. Also included are Lightning, Osage, and Roebuck soils in slightly lower areas than Verdigris soil and areas of Tullahassee soils that have a sandier surface layer. The included soils make up about 15 percent of the map unit, but areas of these soils are generally less than 5 acres.

This Verdigris soil is mainly used for native range. In a few areas, it is used for tame pasture plants or forest of elm, oak, hickory, and pecan.

This soil has low potential for row crops and small grains because of flooding.

This soil has high potential for tame pasture and native grasses. Bermudagrass or tall fescue and clover are the most commonly used tame pasture. The main concerns in management are surface wetness and ponding, frequent flooding, maintaining soil tilth, and improving water intake of the soil. Wet and ponded areas can be planted with water-tolerant grasses. A simple drainage system in these areas can help to establish tame pastures and to increase production on these pastures. Growth of tame pasture plants can also be increased by adding fertilizer to the soil and by controlling grazing. Overgrazing causes surface compaction, which decreases water intake. A good grass mulch helps to maintain soil tilth and improve water intake.

This soil has low potential for most urban uses because of flooding. The hazard of flooding can be reduced but not completely eliminated by upstream flood control structures.

This Verdigris soil is in capability subclass Vw and in the Loamy Bottomland range site.

78—Woodson silty clay loam, 0 to 1 percent slopes. This soil is deep, somewhat poorly drained, and nearly level. It is on stream terraces or uplands in prairie areas. Slopes are smooth and concave. Individual areas are mostly 25 to 100 acres, but some areas are about 10 acres.

Typically, the surface layer is black silty clay loam about 12 inches thick. The subsoil extends to a depth of about 48 inches. It is very dark gray silty clay to a depth of about 16 inches, dark grayish brown silty clay to a depth of about 24 inches, and dark gray clay below that. The underlying material is light olive brown clay to a depth of about 70 inches.

This soil is high in natural fertility, and the organic matter content is moderate to moderately high. The surface layer is medium acid or slightly acid. Permeability is very slow, and the available water capacity is high. The soil has fair tilth and can be worked only within a narrow range of moisture content. The root zone is clayey, but it can be penetrated by plant roots. This soil has a perched high water table at a depth of 0.5 foot to 2 feet in the winter and spring.

Included with this soil in mapping are intermingled areas of Dennis, Okemah, and Parsons soils that are on lower convex side slopes and in smooth, nearly level areas. The included soils make up about 10 to 15 percent of the map unit, but areas of these soils generally are less than 3 acres.

This Woodson soil is used mainly as pasture and hayland, although a small amount is used for cultivated crops.

This soil has high potential for row crops and small grains, but seasonal wetness is a limitation. Good tilth and water intake can be maintained by returning crop residue to the soil. Erosion is a slight hazard if clean-tilled crops are grown. A diversion terrace can be used to break long slopes and help reduce soil loss by erosion. Conservation tillage, cover crops, and grasses and legumes in the cropping system slow runoff and help control erosion.

This soil has medium potential for native grasses and tame pasture. A combination of bermudagrass or tall fescue and clover is commonly used for pasture. Controlling weeds, proper grazing, and preventing wildfires improve the quality and quantity of forage. Fertilizer also increases the quantity of forage.

This soil has low potential for most urban uses, but there is no significant limitation for sewage lagoons. Wetness and the high shrink-swell potential are the main limitations for dwellings, small commercial buildings, and roads and streets. Most of these limitations can be overcome by proper structural design or by altering the soil.

This Woodson soil in in capability subclass IIs and in the Claypan Prairie range site.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Muskogee County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 5 percent.

The following map units, or soils, make up prime farmland in Muskogee County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have limitations, such as a high water table or flooding, may qualify as prime farmland if these limitations are overcome by such measures as drainage or flood control. In the following list, the measures needed to overcome the limitations of a map unit, if any, are shown in parentheses after the map unit name. Onsite evaluation is necessary to determine if the limitations have been overcome by the corrective measures.

2	Bates loam, 1 to 3 percent slopes
3	Bates loam, 3 to 5 percent slopes
7	Caspiana silt loam, rarely flooded
8	Choska silt loam, rarely flooded
9	Choteau loam, 1 to 3 percent slopes
12	Dennis silt loam, 1 to 3 percent slopes
13	Dennis silt loam, 3 to 5 percent slopes
21	Garton silt loam, rarely flooded
24	Kamie fine sandy loam, 1 to 3 percent slopes
25	Kamie fine sandy loam, 3 to 5 percent slopes
28	Keo very fine sandy loam, rarely flooded
35	Latanier silty clay loam, rarely flooded
36	Lightning silt loam, occasionally flooded
37	Linker fine sandy loam, 1 to 3 percent slopes
38	Linker fine sandy loam, 3 to 5 percent slopes
39	Mason silt loam, rarely flooded, 0 to 1 percent slopes
40	Mason silt loam, rarely flooded, 1 to 3 percent slopes
41	Muldrow silty clay loam, rarely flooded
42	Norwood silt loam, rarely flooded
44	Okay very fine sandy loam, 0 to 1 percent slopes
45	Okay very fine sandy loam, 1 to 3 percent slopes
46	Okemah silt loam, 0 to 1 percent slopes
47	Oktaha fine sandy loam, 1 to 3 percent slopes
48	Oktaha fine sandy loam, 3 to 5 percent slopes
51	Osage silty clay loam, rarely flooded
52	Parsons silt loam, 0 to 1 percent slopes
53	Parsons silt loam, 1 to 3 percent slopes
57	Roebuck clay, rarely flooded

58 Roebuck clay, occasionally flooded
60 Roxana very fine sandy loam, rarely flooded, 0 to 1 percent slopes
61 Roxana very fine sandy loam, rarely flooded, 1 to 3 percent slopes
62 Severn very fine sandy loam, rarely flooded, 0 to 1 percent slopes
63 Severn very fine sandy loam, rarely flooded, 2 to 6 percent slopes
64 Shermore loam, 3 to 5 percent slopes
66 Spiro silt loam, 1 to 3 percent slopes
67 Stigler silt loam, 0 to 1 percent slopes
68 Stigler silt loam, 1 to 3 percent slopes
70 Taloka silt loam, 0 to 1 percent slopes
71 Taloka silt loam, 1 to 3 percent slopes
75 Verdigris silt loam, rarely flooded
76 Verdigris silt loam, occasionally flooded
78 Woodson silty clay loam, 0 to 1 percent slopes

Use and Management of the Soils

Don K. Hubbard, district conservationist, Soil Conservation Service, helped prepare this section.

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Keith Vaughan, state conservation agronomist, and David Legg, area range conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 292,660 acres in Muskogee County was used for crops and pasture in 1974, according to the Soil Conservation Service land use inventory. Of this, 152,900 acres was used for pasture; 53,000 acres for row crops; 80,760 acres for close-growing crops, mainly wheat and oats; and 6,000 acres for rotation hay and pasture. The rest was used for other crops.

The soils in Muskogee County have good potential for increased production of food. Potentially good cropland is used as rangeland or woodland, and several thousand acres is used for pasture. In addition to the reserve productivity capacity represented by this land, food production can be increased by using the latest crop production technology on all cropland in the county. This soil survey can help facilitate the application of such technology.

The acreage in crops and woodland has gradually been decreasing as more and more land is used for urban development. In 1974, about 22,730 acres was used as urban and built-up land in the county. This figure has increased at the rate of about 40 acres per year.

Soil erosion is a major concern on the cropland in Muskogee County. If slope is more than 1 percent, erosion is a hazard. Bates, Choteau, Dennis, Parsons, and Taloka soils for example, have slope of 1 percent or more.

Erosion reduces productivity as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Carytown, Choteau, Dennis, Parsons, Stigler, Taloka, and Woodson soils.

Soil erosion on farmland also results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water

for municipal use, recreation, and for use by fish and wildlife.

Control of erosion provides protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. Conservation tillage and crop residue left on the soil increase infiltration and reduce the hazards of runoff and erosion.

Terraces and diversions reduce the length of slope and thus reduce runoff and erosion. They are not practical on deep, sandy soils. Dennis soils, for example, are suitable for terraces, but Coweta soils are less suitable for terraces and diversions because of bedrock at a depth of less than 20 inches.

Contouring and contour stripcropping are effective in erosion control. They are best adapted to soils that have smooth uniform slopes, including most areas of Bates, Carytown, Choteau, Dennis, Okay, Parsons, Stigler, and Taloka soils.

Soil blowing is a hazard on Larton loamy fine sand in some areas. Soil blowing can damage these soils when winds are strong if the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or a rough surface by proper tillage minimizes soil blowing on these soils.

Field crops suited to the soils and climate of Muskogee County include many that are not now commonly grown. Peanuts, grain sorghum, and soybeans are the main row crops. Potatoes, cotton, and similar crops can be grown if economic conditions are favorable. Wheat is the common close-growing crop. Rye, barley, and oats could be grown, and fescue and lovegrass seed could be produced.

Specialty crops in the county are vegetables, small fruits, tree fruits, and nursery plants. A small acreage throughout the county is used for melons, strawberries, sweet corn, tomatoes, peppers, and other vegetables and small fruits. Some sizeable areas are also suited to other special crops, such as grapes and many vegetables. Apples, peaches, and pecans are the most important tree fruits grown.

Tame Pasture

Much of the acreage in Muskogee County is in tame pasture plants. The trend is to convert cropland and woodland to pasture. To a lesser degree, range is also being converted to pasture.

The principal pasture grass is improved bermudagrass. Some of the better pastures of bermudagrass are overseeded with legumes. This practice increases the quality and quantity of forage and provides additional plant food (fig. 11).

Some bermudagrass pastures are overseeded with fescue. This forage mixture is especially adapted to soils on flood plains where additional moisture is available. Fescue provides grazing in nearly all months and furnishes added protein for livestock when bermudagrass is dormant. To maintain a vigorous stand of fescue, fertilizer should be applied early in spring and early in fall. The fescue pasture should not be grazed during summer.

Weeping lovegrass is grown on a few acres in the county. It is a warm-season perennial bunchgrass suited to well drained, loamy and sandy soils. Weeping lovegrass begins earlier in the spring than bermudagrass and remains green later in the fall. It responds well to fertilizer, especially nitrogen. The grass becomes less palatable to cattle as it matures.

Some areas of cropland are used for forage plants that supplement the permanent grasses. Small grains in the pasture program provide grazing and additional protein for livestock late in fall and during spring. These grains need to be seeded and fertilized late in summer or early in fall to help obtain the maximum amount of forage. They can be grazed until maturity, or livestock can be removed in spring to allow the plants to grow a seed crop for harvest. Wheat, oats, barley, and rye are the main small grains used for grazing.

Forage sorghum, an annual grass, is also used on some cropland to supplement permanent grasses. It can be used in the pasture program to provide grazing during the summer, or it can be harvested for hay. In some areas, forage sorghum is allowed to grow until frost and is grazed in the winter. Fertilizer should be used to help obtain maximum growth. Plains and Caucasian bluestem are good grasses to use in a pasture management program in Muskogee County, These grasses grow on all soils in the county except for those that are frequently flooded or that are saline or alkali. The yield for Caucasian bluestem is about 15 to 20 percent more than the yield for plains bluestem given in table 5. Livestock prefer plains bluestem over Caucasian bluestem during certain parts of the year.

Pasture Management

The kind of soil and the plants to which it is suited must be considered in tame pasture management. Good pasture can be attained by maintaining the desired plants in the stand. Plants must have vigor to keep a proper balance in the stand. Grazing needs to be compatible with the growth cycle of the plants.

Proper grazing and rotation grazing help lengthen the life of most tame pasture plants. Deferred grazing when tame pasture plants are under the most stress is beneficial. It allows the plants to regain vigor by helping to maintain a large root system where food can be stored for the next growing season; thus the total production of forage increases.

Fertilizer that contains the proper elements contributes to more vigorous pasture plants. It also increases the amount of forage and lengthens the lifespan of the plant.

Figure 11.—Most of the tame pasture in Muskogee County is bermudagrass. Hay is harvested from this pasture on Taloka silt loam, 0 to 1 percent slopes.

Plant food can be added by using commercial fertilizers or legumes, or both, that furnish nitrogen. The acidity of the soil needs to be adjusted to the kinds of plants desired in the stand. Large amounts of plant food, especially nitrogen, are needed unless legumes are grown with the grass.

Desirable pasture plants can be maintained in the stand only by controlling the invasion of undesirable plants. Weeds need to be controlled. Brush control is essential on soils where trees grow. Mowing or spraying, or both, properly used, help control weeds and brush.

Planning a Pasture Program

A pasture program can be planned so that adequate forage is available during every month of the year. A study of the growth habits of different plants is necessary. The months in which various kinds of forage plants grow and the monthly percentage of annual growth for each kind of plant are shown in the accompanying graph (fig. 12). For example, bermudagrass makes 24 percent of its yearly growth during June.

Soils vary in their capacity to produce forage for grazing. Dennis soils produce more forage than Coweta soils mainly because they furnish more available moisture to plants. The total yearly production of common pasture plants for each soil is given in animal unit months (AUM) in table 5. For example, bermudagrass on 1 acre of Dennis silt loam, 1 to 3 percent slopes, can furnish grazing for one animal unit for 7 months per year.

In planning a pasture program, the total yearly production of the pasture plant in AUM and the normal growth made by the plant in a particular month should be considered. For example, bermudagrass furnishes 24

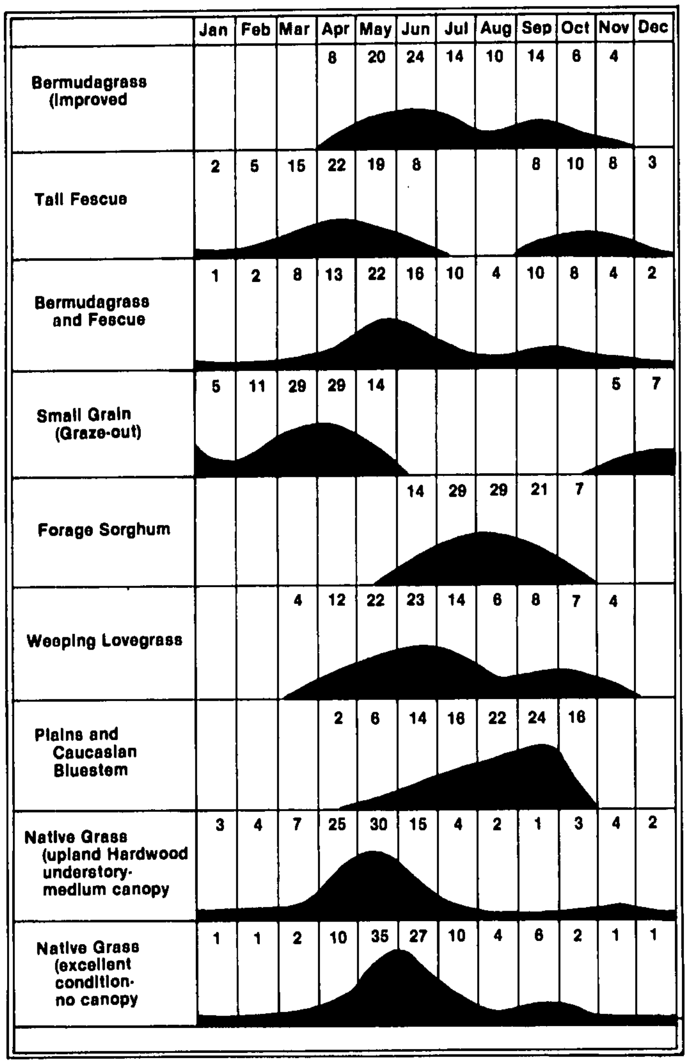


Figure 12.—Forage calendar showing monthly growth as a percentage of forage produced annually.

percent of its annual forage during June. The yearly production on Dennis silt loam, 1 to 3 percent slopes, is 7 AUM. Since 24 percent of 7 AUM is 1.7 AUM, 1 acre of this soil provided grazing for 1.7 animals in June. Therefore, a 50-acre bermudagrass pasture would furnish grazing for 85 animals during June. Soil Conservation Service or County Extension Office personnel can help plan a pasture program.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode, but they have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w,* or *s,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

There are no subclasses in class I because the soils of this class have few limitations. The soils in class V are subject to little or no erosion, but they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation. Class V contains only the subclasses indicated by *w,* or *s.*

The capability class or subclass of each soil is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

Ernest C. Snook and David E. Legg, range conservationists, Soil Conservation Service, helped prepare this section.

Rangeland is land on which native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. The plants are generally suitable for grazing and are sufficiently abundant to be used for grazing. The composition and production of the plant community is determined by soil, climate, topography, and grazing management.

According to records of the local field office of the Soil Conservation Service, 15 percent of Muskogee County is used as rangeland. The rangeland plant community is a wide variety of native grasses interspersed with an abundance of forbs.

Muskogee County has four distinct types of rangeland. In the western and south-central part of the county, most of the soils are loamy and are moderately deep to deep over loamy or clayey sediment. These soils support tall grasses, and potential productivity is high. In much of the area east of the Arkansas River and in the southern part of the county, the soils are loamy and are shallow to moderately deep over loamy or clayey sediment. Large areas are characterized by steep slopes. These areas support tall grasses and low-quality timber. Potential productivity is moderate because of shallow rooting depth and low available water capacity. In the southern and eastern parts of the county along the Arkansas and South Canadian River and major creeks, the soils are loamy and are deep over loamy and clayey sediment. These soils support tall grasses, and potential productivity is much higher than on the shallow soils. The soils along the Arkansas and South Canadian Rivers are sandy, loamy, or clayey and are deep over loamy sediment. These soils support tall grasses, and the potential productivity is high.

The plant community of Muskogee County has changed drastically over the past 75 years. Excessive concentration of animals on native vegetation has resulted in a reduction of the high-quality vegetation and an accompanying loss in grazing use. Now, tall grasses flourish in only a few places. Areas that were once open rangeland are now partly or fully covered with invader species of brush and have been replaced by a mixture of poor-quality grasses and forbs. The amount of forage presently produced may be less than half of that originally produced; however, remnants of the original plant species are still in protected areas on most rangeland. In most cases, good grazing management allows these high quality plants to reestablish themselves.

Although most of the local ranches and livestock farms are cow-calf operations, there are some stocker enterprises. Many ranches supplement their cow herds with stockers, thus achieving greater flexibility in adjusting the number of livestock to be cared for in periods of drought.

About 75 percent of the annual forage production of rangelands takes place in April, May, and June when spring rains and moderate temperatures are favorable for the growth of warm-season plants. A secondary growth period generally occurs in September and October when fall rains and gradually cooling temperatures are common.

Livestock operations generally supplement the grazing of native grassland with the grazing of improved pasture and cropland. Improved bermudagrass, and tall fescue are common supplemental pasture grasses. Protein supplement, hay, and grazing of small grains supplement livestock feeding throughout the winter.

Droughts of varying length are frequent in this area. Some are short, midsummer droughts, but others can last for several months.

Range Sites and Condition Classes

A range site is a distinctive kind of rangeland that produces a characteristic climax or potential plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Climax vegetation on the range site is the stabilized plant community that the site is capable of producing. It consists of plants that grew there before settlement of the region. With good management, this plant community reproduces itself and changes very little as long as the environment remains unchanged. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers, or preferred plants, are the plants in the climax vegetation that tend to decrease in relative amount under continued close grazing. They generally are the tallest and most productive perennial grasses and forbs, and they are the most palatable to livestock.

Increasers, or desirable plants, are the plants that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders, or undesirable plants, are those that cannot compete with desirable plants in the climax plant community for moisture, nutrients, and light. However, invaders grow along with increasers after the climax vegetation has been reduced by grazing. Some invaders have little value for grazing.

The range condition is judged according to the standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site. Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation. The classes show the present condition of the native vegetation on a range site as compared to the native vegetation that could grow there. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition, plant vigor, and the moisture available to plants during the growing season. Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipication and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Table 7 shows, for each soil, the range site and the total annual production as dry weight of vegetation in favorable, normal, and unfavorable years. Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

A primary objective of good range management is to keep the range in excellent or good condition. If the range is well managed, water is conserved, yields are improved, and the soils are protected. The main concern in management is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, whereas actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods may have a degraded appearance that temporarily conceals its quality and ability to recover. Following years of prolonged overuse of rangeland, seed sources of the desirable vegetation will have been eliminated. When this happens, the vegetation needs to be reestablished for management to be effective.

Range management practices suitable for Muskogee County are proper grazing, deferred grazing, or a planned grazing system. Facilitating practices are stock water development, fencing, and the placement of salting and feeding locations. When regression has occurred and undesirable plants dominate, accelerating practices, such as range seeding, brush management, weed management, and prescribed burning, should be considered singly or as part of a range management system. These practices properly applied and maintained generally result in the optimum production of vegetation, reduction of undesirable species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and adequately protects soil and water resources.

The following information contains guidelines for potential annual utilization on a broad scale. If more detail is needed for a particular area or situation, consult the local office of the Soil Conservation Service.

To maintain or improve the quality and quantity of native vegetation, the amount of removal depends on the potential productivity and condition of the site. As a rule, about 50 percent of the annual season's growth should be left on the soil surface. The bottom third of

the height of tall and mid grasses at maturity equals about 50 percent of the annual production. If 50 percent of the annual season's growth remains on the site, the natural balance of soil, plants, animals, and environment is sustained.

The remaining 50 percent of annual growth may or may not be removed from the site. The removal can be by living organisms, rodents, insects, mammals and deterioration caused by climatic variations. Generally, mammals, such as livestock, remove about 50 percent of the growth from the site or 25 percent of the total annual season's growth, by weight. For example, the forage available for livestock on a Loamy Prairie range site in excellent condition, for an average growing season, would be 5,500 pounds of air-dry vegetative material. This 5,500 pounds includes all plant production of grasses, forbs, and woody species. Generally woody species would not be considered livestock forage. The percentage of grasses, forbs, and woody species are listed in the individual range site descriptions.

About 25 percent, or 1,375 pounds, of the average productivity of grasses and forbs is available for livestock forage. A 1,000 pound cow is equivalent to one animal unit (A.U.). The cow consumes 2.5 to 3 percent of its body weight of forage per day. The requirement for one animal unit is 25 to 30 pounds of air-dry forage per day. In 1 month (30 days), an animal will consume from 750 to 900 pounds of native vegetation, mainly grass, depending on quality and stage of growth of the forage plants.

To convert available forage from one acre of Loamy Prairie range site in excellent condition, divide 1,375 pounds of production by 25 to 30 pounds (A.U. forage required per day). One acre of a soil in this range site can produce forage for one animal unit for 46 to 55 days. To convert forage available from one acre to animal unit month, divide the available forage (1,375 pounds) by the forage requirement for one animal unit (750 to 900 pounds). The result would be 1.9 AUM to 1.52 AUM per acre. It would require from 6.1 to 7.9 acres of a Loamy Prairie range site in excellent condition to run one range cow for 12 months or year-round.

Muskogee County has 16 range sites. They are Claypan Prairie, Deep Sand Savannah, Eroded Prairie, Eroded Sandy Savannah, Heavy Bottomland, Loamy Bottomland, Loamy Prairie, Loamy Savannah, Sandy Bottomland, Sandy Savannah, Savannah Breaks, Shallow Claypan, Shallow Prairie, Shallow Savannah, Subirrigated, and Very Shallow.

Claypan Prairie range site. The Parsons and Woodson soils in map units 52, 53, 54, 55, and 78 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 80 percent grasses, 15 percent forbs, and 5 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, prairie scurfpea, Illinois bundleflower, leadplant, and blacksampson, gay feathers, wildgrape, and poison-ivy are preferred plants and make up 70 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as meadow dropseed, sideoats grama, Scribner panicum, fringeleaf paspalum, buffalograss, wildindigo, ashy sunflower, milkweeds, sagewort, goldenrods, winged elm, and sumacs.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, silver bluestem, windmillgrass, threeawns, Japanese brome, showy partridgepea, ragweeds, croton, bitter sneezeweed, persimmon, and hawthorn, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Deep Sand Savannah range site. The Glenpool and Larton soils in map units 22, 23, 32, and 33 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 70 percent grasses, 15 percent forbs, and 15 percent woody plants.

Big bluestem, indiangrass, little bluestem, switchgrass, Illinois bundleflower, and perennial sunflowers are preferred plants and make up 70 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as purpletop, dropseeds, Scribner panicum, sand lovegrass, wildindigo, Texas bullnettle, heath aster, milkweeds, goldenrods, sagewort, queensdelight, hickory, blackjack oak, post oak, cedar, and winged elm.

Continuous overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, annual threeawns, showy partridgepea, common yarrow, ragweeds, white snakeroot, persimmon, and sassafras, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species increase.

Eroded Prairie range site. The Dennis soil in map 15 is in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 70 percent grasses, 20 percent forbs, and 10 percent woody plants.

Little bluestem, gayfeather, big bluestem, indiangrass, tickclover, and perennial sunflower are preferred plants and make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are

replaced by desirable plants, such as tall dropseed, Scribner panicum, wildindigo, heath aster, goldenrod, sagewort, sumacs, and blackberry.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge, splitbeard bluestem, silver bluestem, Japanese brome, threeawn, showy partridgepea, broomweed, ragweed, croton, persimmon, post oak, and blackjack oak, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species.

Eroded Sandy Savannah range site. The Kamie and Larton soils in map units 26 and 34 are in this site. In most places, this site is formerly cultivated soils.

The potential plant community is a tall grass aspect. Species composition, by weight, is 70 percent grasses, 15 percent forbs, and 15 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, sand lovegrass, and perennial lespedezas and sunflowers are preferred plants and make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as tall dropseed, meadow dropseed, purpletop, Scribner panicum, sedges, sideoats grama, wildindigo, wild alfalfa, dotted gayfeathers, heath aster, Missouri goldenrod, post oak, blackjack oak, sumacs, and blackberry.

Continued overgrazing and the extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as annual threeawn, little barley, mat sandburgrass, silver bluestem, splitbeard bluestem, broomsedge bluestem, showy partridgepea, plantains, buffalobur, annual sunflower, and ragweeds, dominate the site. The undesirable plants dominate the site, potential forage production is greatly reduced.

Heavy Bottomland range site. The Latanier, Lightning, Muldrow, Osage, and Roebuck soils in map units 35, 36, 41, 51, 57, 58, and 59 are in this site.

The potential plant community is a tall grass aspect. Species composition by weight, is 65 percent grasses, 20 percent forbs, and 15 percent woody plants.

Eastern gamagrass, cordgrass, river switchgrass, big bluestem, indiangrass, switchgrass, Florida paspalum, leadplant, tickclover, wholeleaf rosinweed, and gayfeathers are preferred plants and make up 70 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as little bluestem, tall dropseed, sedges, jointtail, Scribner panicum, sideoats grama, buffalograss, wildindigo, wild alfalfa, perennial sunflowers, heath aster, goldenrods, and American elm.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as windmillgrass, tumblegrass, Japanese brome, cheat, threeawns, silver bluestem, seacoast sumpweed, common broomweed, ragweeds, ironweed, post oak, blackjack oak, and blackhaw, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Loamy Bottomland range site. The Caspiana, Choska, Cupco, Garton, Keo, Mason, Norwood, Roxana, Severn, and Verdigris soils in map units 7, 8, 11, 17, 21, 28, 39, 40, 42, 60, 61, 62, 63, 75, 76, and 77 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 70 percent grasses, 20 percent forbs, and 10 percent woody plants.

Eastern gamagrass, Florida paspalum, prairie cordgrass, big bluestem, indiangrass, switchgrass, switchcane, leadplant, Illinois bundleflower, compassplant, gayfeather, and passion vine are preferred plants and make up 75 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as little bluestem, tall dropseed, Scribner panicum, sedges, rushes, wildindigo, perennial sunflowers, goldenrods, trumpetvine, winged elm, sumacs, and indigobush.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as silver bluestem, splitbeard bluestem, broomsedge bluestem, sideoats grama, Japanese brome, three awns, showy partridgepea, ragweeds, bitter sneezeweed, ironweed, white snakeroot, persimmon, hawthorn, post oak, and blackjack oak, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Loamy Prairie range site. The Bates, Choteau, Dennis, Eram, Okay, Okemah, Spiro, and Taloka soils in map units 2, 3, 4, 5, 6, 9, 12, 13, 14, 17, 20, 44, 45, 46, 66 70, and 71 are in this site.

The potential plant community is a tall grass aspect. Species composition by weight, is 75 percent grasses, 20 percent forbs, and 5 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, eastern gamagrass, Flordia paspalum, leadplant, Illinois bundleflower, compassplant, wholeleaf rosinweed, and

gayfeathers are preferred plants and make up 75 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as tall dropseed, sideoats grama, jointtail, Scribner panicum, longspike tridens, purpletop, wildindigo, wild alfalfa, ashy sunflower, heath aster, milkweeds, goldenrods, sagewort, American elm, winged elm, sumac, and indigobush.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, silver bluestem, Japanese brome, threeawns, showy partridgepea, ragweeds, narrowleaf sumpweed, bitter sneezeweed, ironweed, white snakeroot, persimmon, hawthorn, post oak, and blackjack oak, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Loamy Savannah range site. The Enders and Stigler soils in map units 18, 67, and 68 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 65 percent grasses, 20 percent forbs, and 15 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, wildryes, leadplant, tephrosis, Illinois bundleflower, perennial lespedeza, gayfeathers, perennial sunflowers, wildgrape, and poison-ivy are preferred plants and make up 70 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as tall dropseed, jointtail, sideoats, Scribner panicum, purpletop, wildindigo, ashy sunflower, heath aster, milkweeds, goldenrods, blackberry, American elm, roughleaf dogwood, sassafras, post oak, and blackjack oak.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, fringeleaf paspalum, threeawns, annual brome, showy partridgepea, deervetch, narrowleaf sumpweed, ragweeds, bitter sneezeweed, croton, persimmon, and hawthorn, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species increase.

Sandy Bottomland range site. The Kiomatia soils in map units 29, 30, and 31 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 75 percent grasses, 15 percent forbs, and 10 percent woody plants.

Eastern gamagrass, river switchgrass, switchgrass, big bluestem, indiangrass, Illinois bundleflower, and perennial sunflowers are preferred plants and make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as little bluestem, dropseeds, jointtail, Scribner panicum, purpletop, wildindigo, Texas bullnettle, heath aster, goldenrods, chittam, elm, sumacs, and willow.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge, splitbeard bluestem, Japanese brome, threeawns, showy partridgepea, seacoast sumpweed, ragweeds, ironweeds, white snakeroot, sassafras, and persimmon, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species increase.

Sandy Savannah range site. The Linker, Kamie, Oktaha, and Shermore soils in map units 18, 24, 25, 37, 38, 47, 48, 49, 50, and 64 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 70 percent grasses, 15 percent forbs, and 15 percent woody plants.

Big bluestem, indiangrass, switchgrass, eastern gamagrass Florida paspalum, tephrosia, Illinois bundleflower, tickclover, and gayfeathers are preferred plants and make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as meadow dropseed, sideoats grama, jointtail, Scribner panicum, purpletop, sand lovegrass, wildindigo, wild alfalfa, ashy sunflower, heath aster, sageworts, sumacs, wild plum, postoak, and blackjack oak.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, fringeleaf paspalum, Japanese brome, threeawns, showy partridgepea, ragweeds, croton, bitter sneezeweed, persimmon, and hawthorn, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species increase.

Savannah Breaks range site. The Endsaw and Hector soils in map unit 19 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 75 percent grasses, 15 percent forbs, and 10 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, tickclover, Illinois bundleflower, perennial sunflowers, and

gayfeathers are preferred plants and make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as dropseed, sideoats grama, jointtail, Scribner panicum, wildindigo, heath aster, goldenrods, post oak, blackjack oak, sumacs, and chittam.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, Japanese brome, threeawns, deervetch, ragweeds, bitter sneezeweed, croton, persimmon, and winged elm, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Shallow Claypan range site. The Carytown soil in map unit 55 is in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 80 percent grasses, 15 percent forbs, and 5 percent woody plants.

Switchgrass, indiangrass, big bluestem, little bluestem, beaked panicum, wildryes, yellow neptunia, Illinois bundleflower, and gayfeathers are preferred plants and make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as longspike tridens, dropseeds, sedges, Scribner panicum, wildindigo, milkweeds, goldenrods, chittam, blackberry, and hackberry.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, threeawns, buffalograss, deervetch, ragweeds, broomweeds, croton, hawthorn, and winged elm, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Shallow Prairie range site. The Coweta soils in map units 5, 6, 10, and 20 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 75 percent grasses, 20 percent forbs, and 5 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, tephrosia, catclaw sensitivebrier, perennial sunflowers, and skunkbush are preferred plants and make up 65 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as dropseeds, jointtail, Scribner panicum, buffalograss, wildindigo, milkweeds, sagewort, sumacs, and indigobush.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as broomsedge bluestem, splitbeard bluestem, Japanese brome, showy partridgepea, common bromewood, ragweeds, bitter sneezeweed, crotons, persimmon, and hawthorn, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Shallow Savannah range site. The Hector soils in map units 18 and 50 are in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 65 percent grasses, 20 percent forbs, and 15 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, perennial lespedezas, Illinois bundleflower, perennial sunflowers, gayfeathers, and poison-ivy are preferred plants and make up 60 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as dropseeds, sideoats grama, jointtail, Scribner panicum, purple lovegrass, wildindigo, wild alfalfa, heath asters, goldenrods, winged elm, sumacs, post oak, and blackjack oak.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as windmillgrass, broomsedge bluestem, splitbeard bluestem, Japanese brome, threeawns, showy partridgepea, ragweeds, bitter sneezeweed, crotons, white snakeroot, ironweed, persimmon, and hawthorn, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species increase.

Subirrigated range site. The Tullahassee soil in map unit 73 is in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Eastern gamagrass, switchgrass, big bluestem, indiangrass, prairie cordgrass, Illinois bundleflower, and perennial sunflowers are preferred plants and make up 85 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as tall dropseed, purpletop, Scribner panicum, sedges, rushes, cottonweed, buttonbush, and willow.

Continued overgrazing and extreme climatic conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as cool-season annuals, threeawns, and annual forbs dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced and woody species increase.

Very Shallow range site. The Shidler soil in map unit 65 is in this site.

The potential plant community is a tall grass aspect. Species composition, by weight, is 75 percent grasses, 20 percent forbs, and 5 percent woody plants.

Big bluestem, indiangrass, switchgrass, little bluestem, wildryes, catclaw sensitivebrier, perennial lespedezas, prairie clovers, gayfeathers, willowleaf sunflower, pitchersage, poison-ivy, and Jersey tea are preferred plants and make up 75 percent of livestock forage production if the range is in excellent condition. The preferred plants disappear first under continuous heavy grazing. They are replaced by desirable plants, such as sedges, dropseeds, Scribner panicum, sideoats grama, silver bluestem, wildindigo, wild alfalfa, heath aster, milkweeds, gayfeathers, pricklypear cactus, elm, sumacs, and blackberry.

Continued overgrazing and extreme conditions cause a decline in the desirable plants. As the range site deteriorates, undesirable plants, such as little barley, windmillgrass, winter bentgrass, hairy tridens, Japanese brome, threeawns, deervetch, Leavenworth eryngo, common yarrow, common broomweed, ragweeds, croton, hawthorn, and dogwood, dominate the site. When undesirable plants dominate the site, potential forage production is greatly reduced.

Recreation

In table 8, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Billy M. Teels, biologist, Soil Conservation Service, helped prepare this section.

Muskogee County soils provide habitat for good populations of wildlife that are characteristic of eastern Oklahoma. The mixture of crops, range, forest, and pasture provides for the habitat diversity that is important to game, such as dove, quail, turkey, deer, and squirrels, and for furbearers, such as raccoon, fox, oppossum, and mink. Farm ponds and Greenleaf Lake provide good habitat for wintering waterfowl. Most farm ponds have

been stocked with bass and bluegill sunfish. The Arkansas Navigation system provides a large fishery for white and striped bass, crappie, catfish, largemouth bass, and various sunfish.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Engineering

Charles E. Bollinger, assistant state conservation engineer, and Timothy M. Miller, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet, and because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations must be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to: evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. Depth to a high water table, depth to bedrock or to a cemented

pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted,

and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table N, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct

surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 14.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area, or from nearby areas, and on field examination.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They influence the soil's adsorption of cations, moisture retention, shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Less than 1 percent of the soils in Muskogee County have, or are suspected of having, dispersive clays. Recognition and proper treatment of these soils are very important. The dispersive clays can cause problems in using conservation engineering practices unless the material is specially treated. These clays are mainly in the subsoil, and they can go unnoticed unless exposed by gullies. Carytown soils have dispersive clays because of their sodium content. Oil-waste land can also have the dispersive clay conditions. Treatment with lime can effectively stabilize these soils that remain exposed. Agricultural gypsum can effectively stabilize these soils in waterways, terrace channels, and ridges. Designs for embankments made of soils that have dispersive clays involve a combination of lime treatment and special placement of the fill material.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE)

to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17 and the results of chemical analysis in table 18. The data are for soils sampled at carefully selected sites. Soil samples were analyzed by Soil Morphology, Genesis, and Classification Laboratory, Department of Agronomy, Oklahoma State University.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(7)*.

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Organic matter—peroxide digestion (6A3).
Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (6O2), sodium (6P2), potassium (6Q2).
Cation-exchange capacity—sum of cations (5A3a).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1a).
Total phosphorus—perchloric acid; colorimetry (6S1a).

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by Oklahoma Department of Transportation, Materials Division.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(6)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning fluvial, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Udifluvents (*Ud*, meaning humid, plus *fluvent*, the suborder of the Entisols that has an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Udifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-silty, mixed, nonacid, thermic Typic Udifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series. An example is the Roxana series, which is a member of the coarse-silty, mixed, nonacid, thermic family of Typic Udifluvents.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (5)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (6)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Barge Series

The Barge series consists of deep, well drained, moderately slowly permeable soils on spoil banks along the Arkansas and Verdigris Rivers. These soils are gently sloping to steep. They formed in loamy material, dredged from river channels. Slopes range from 3 to 30 percent. Soils of the Barge series are fine-silty, mixed, nonacid, thermic Hapludollic Arents.

Barge soils are associated with Norwood, Osage, Roebuck, Roxana, and Verdigris soils. All of these soils

are lower in elevation than Barge soils and do not have fragments of a mollic epipedon in the lower layers. Norwood soils are calcareous. Osage, Roebuck, and Verdigris soils have a mollic epipedon. Roebuck soils also have more than 35 percent clay in the control section. Roxana soils have less than 18 percent clay in the control section.

Typical pedon of Barge silt loam, 3 to 30 percent slopes; 4,250 feet south and 975 feet west of the northeast corner sec. 5, T. 15 N., R. 19 E.

Ap—0 to 7 inches; brown (7.5YR 4/4) silt loam; weak fine granular structure; very friable; many fine roots; mildly alkaline; clear smooth boundary.

C—7 to 60 inches; reddish brown (5YR 4/3) silty clay loam; massive; friable; common masses of reddish yellow (5YR 6/6) very fine sandy loam and dark brown (7.5YR 4/2) silt loam; few fine roots; mildly alkaline.

The Ap horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 3 or 4. The texture is dominantly silt loam but ranges from silty clay loam to very fine sandy loam. Reaction is neutral to mildly alkaline.

The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 2 to 6. The texture is silty clay loam, clay loam, silt loam, and loam. Thin layers of finer and coarser material are below a depth of 40 inches. The C horizon has masses that can be identified as parts of former mollic epipedons of associated soils. Reaction is neutral to moderately alkaline.

Bates Series

The Bates series consists of moderately deep, well drained, moderately permeable soils. Bates soils formed in residuum weathered from acid sandstone that has thin interbeds of shale (fig. 13). These soils are very gently sloping or gently sloping and are on uplands. Slopes are 1 to 5 percent. Soils of the Bates series are fine-loamy, siliceous, thermic Typic Argiudolls.

Bates soils are associated with Coweta and Dennis soils. Coweta soils are in higher positions than Bates soils and are 10 to 20 inches thick. Dennis soils are in lower positions and are in the fine family.

Typical pedon of Bates loam, 1 to 3 percent slopes; 2,000 feet east and 500 feet south of the northwest corner of sec. 25, T. 14 N., R. 15 E.

A1—0 to 12 inches; very dark grayish brown (10YR 3/2) loam; weak medium granular structure; very friable; slightly acid; gradual smooth boundary.

B1—12 to 20 inches; brown (10YR 4/3) loam; weak medium subangular block structure; friable; strongly acid; gradual smooth boundary.

B2t—20 to 30 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; strongly acid; clear smooth boundary.

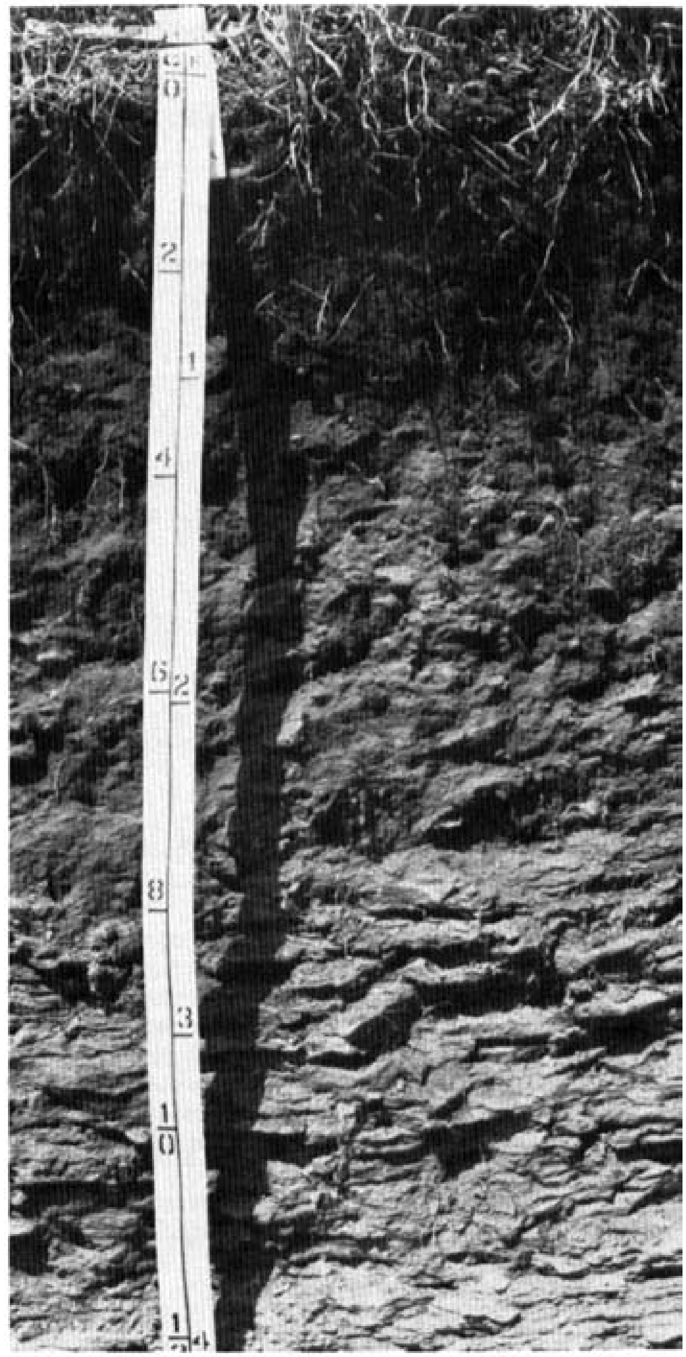


Figure 13.—Profile of Bates loam, 3 to 5 percent slopes, shows soft sandstone at a depth of about 36 inches.

B3—30 to 35 inches; yellowish brown (10YR 5/6) loam; few medium prominent red (2.5YR 4/6) mottles;

weak medium subangular blocky structure; friable; continuous clay films on faces of peds; about 5 percent, by volume, sandstone fragments 2 to 75 mm in diameter; strongly acid; abrupt smooth boundary.

Cr—35 to 60 inches; soft sandstones with thin beds of soft shale.

The solum ranges in thickness from 20 to 40 inches. Reaction ranges from slightly acid to strongly acid.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 2 or 3. The texture is fine sandy loam or loam.

The B1 horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The texture is loam fine sandy or loam.

The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It has mottles in shades of red and brown. The texture is loam, sandy clay loam, or clay loam.

The B3 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Mottles that have value of 4 or higher and chroma of 1 or 2 are in some pedons. The texture is loam, sandy clay loam, clay loam, or sandy loam. Fragments of sandstone 2 to 76 millimeters in diameter range from 0 to 10 percent, by volume.

Carytown Series

The Carytown series consists of deep, poorly drained, very slowly permeable soils formed in sodium-enriched fine material. These soils are nearly level. They are in large, slight depressions that are slightly below adjoining ridgetops. A perched high water table is at the surface or to a depth of 1 foot in the winter and spring. Slopes are 0 to 1 percent. Soils of the Carytown series are fine, mixed, thermic Albic Natraqualfs.

Carytown soils are associated with Parsons and Taloka soils. Parsons and Taloka soils have less than 15 percent sodium in the argillic horizon.

Typical pedon of Carytown silt loam, in an area of Parsons-Carytown silt loams, 0 to 1 percent slopes; about 3 miles south and 2 miles east of Summit, about 2,100 feet south and 350 feet east of the northwest corner of sec. 4, T. 13 N., R. 18 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; common fine and medium roots; strongly acid; abrupt wavy boundary.

B21t—5 to 22 inches; very dark grayish brown (10YR 3/2) clay; moderate medium subangular blocky structure; firm; common fine and medium roots; clay films on faces of peds; grayish silt coatings on faces of peds; medium acid; gradual smooth boundary.

B22t—22 to 32 inches; dark grayish brown (10YR 4/2) clay; weak coarse subangular blocky structure; very firm; few fine roots; clay films on faces of peds; many gypsum crystals; very dark grayish brown (10YR 3/2) silt coatings on faces of peds; medium acid; gradual smooth boundary.

B23t—32 to 62 inches; brown (10YR 4/3) clay; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; very dark grayish brown (10YR 3/2) silt coatings on faces of peds; few fine gypsum crystals; moderately alkaline.

The solum ranges in thickness from 50 to 65 inches.

The Ap horizon ranges from 5 to 10 inches thick. It has hue of 10YR, value of 4, and chroma of 1 or 2. The texture is silt loam, and reaction ranges from strongly acid to neutral.

Some pedons have an A2 horizon. It has hue of 10YR, value 4 to 6, and chroma of 2 or 3. The A2 horizon has mottles that have value of 3 or 4, and chroma of 1 or 2. Reaction ranges from strongly acid to neutral.

The B2t or B3 horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 4. Either the coatings of peds or the matrix have dominant chroma of 2 or less. The texture is clay or silty clay. Reaction ranges from medium acid to mildly alkaline above a depth of 30 inches and from neutral to moderately alkaline below. The exchangeable sodium is 15 percent or more.

Caspiana Series

The Caspiana series consists of deep, well drained, moderately permeable soils that formed in material weathered from loamy alluvium. These soils are nearly level and are on broad, smooth terraces. Slopes range from 0 to 1 percent. Soils of the Caspiana series are fine-silty, mixed, thermic Typic Argiudolls.

Caspiana soils are on the same landscape with Garton, Mason, Muldrow, and Okay soils. Garton and Muldrow soils are in slightly lower positions than the Caspiana soils and have more than 35 percent clay in the control section. Mason soils have a mollic epipedon more than 20 inches thick, and Okay soils are fine-loamy.

Typical pedon of Caspiana silt loam, rarely flooded; 2,300 feet east and 1,000 feet south of the northwest corner of sec. 25, T. 12 N., R. 20 E.

Ap—0 to 10 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; friable common fine roots; neutral; abrupt smooth boundary.

B1—10 to 18 inches; dark brown (7.5YR 3/2) silt loam; weak medium prismatic structure parting to moderate fine granular; friable; common fine roots; neutral; gradual smooth boundary.

B21t—18 to 37 inches; reddish brown (5YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of

peds; common fine roots; neutral; gradual smooth boundary.

B22t—37 to 48 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds; few fine roots; neutral; gradual smooth boundary.

B3—48 to 57 inches; reddish brown (5YR 4/4) silt loam; weak medium prismatic structure; friable; neutral; gradual smooth boundary.

C—57 to 71 inches; yellowish red (5YR 5/6) silt loam; massive; friable; mildly alkaline.

The solum ranges in thickness from 40 to 60 inches.

The A horizon has hue of 7.5YR, value of 3, and chroma or 2 or 3. It ranges from medium acid to neutral.

The B1 horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The texture is silt loam, and reaction is medium acid to neutral.

The B2t horizon has hue of 5YR, value of 4 or 5, and chroma of 3 or 4. The texture is silt loam or silty clay loam. Reaction is slightly acid or neutral.

The B3 horizon has hue of 5YR, value of 4 or 5, and chroma of 4 or 6. The texture is silt loam, very fine sandy loam, or silty clay loam. Reaction is neutral or mildly alkaline.

The C horizon has the same colors and reaction as the B3 horizon. The texture is very fine sandy loam, loam, silt loam, or silty clay loam.

Choska Series

The Choska series consists of deep, well drained, moderately permeable soils on flood plains. These soils are nearly level. They formed in predominantly loamy alluvium under a cover of trees with an understory of native grasses. Slopes range from 0 to 1 percent. Soils of the Choska series are coarse-silty, mixed, thermic Fluventic Hapludolls.

Choska soils are associated with Keo, Kiomatia, Latanier, Roxana, and Severn soils. Keo, Roxana, and Severn soils are in lower positions that Choska soils and do not have a mollic epipedon. Kiomatia soils are in lower positions, do not have a mollic epipedon, and have sandy texture in the control section. Latanier soils are on the back side of the terrace, have vertic properties, and a clayey over loamy control section. Mason soils are in higher positions and have an argillic horizon.

Typical pedon of Choska silt loam, rarely flooded; 4,800 feet east and 2,000 feet north of the southwest corner of sec. 6, T. 15 N., R. 16 E.

A1—0 to 14 inches; dark brown (7.5YR 3/2) silt loam; moderate very fine and fine granular structure; very friable; slightly acid; clear smooth boundary.

B1—14 to 36 inches; yellowish red (5YR 4/6) silt loam; weak fine granular structure; very friable; organic stains in few root channels; neutral; clear smooth boundary.

B2—36 to 50 inches; yellowish red (5YR 4/6) silt loam; weak fine granular structure; very friable; calcareous, moderately alkaline; clear smooth boundary.

C—50 to 67 inches; yellowish red (5YR 5/6) very fine sandy loam; massive; very friable; few thin strata of loamy fine sand, loam, and silt loam; calcareous, moderately alkaline.

The soil is more than 60 inches deep. Some pedons have organic layers below a depth of 24 inches.

The A horizon has hue of 5YR to 10YR, value of 3, and chroma of 2 or 3. Reaction is slightly acid to mildly alkaline.

The B horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6. The texture is very fine sandy loam or silt loam that has thin strata of loamy fine sand to silty clay loam. Reaction is neutral to moderately alkaline, and in most pedons, it is calcareous in the lower part.

The C horizon has colors and textures similar to those of the B horizon. Reaction is mildly alkaline or moderately alkaline and calcareous.

Choteau Series

The Choteau series consists of deep, moderately well drained, slowly permeable soils that formed in alluvium, colluvium, or residuum on uplands or terraces. These soils are very gently sloping. A perched high water table is at a depth of 2 to 3 feet in winter and spring. Slopes are 1 to 3 percent. Soils of the Choteau series are fine, mixed, thermic Aquic Paleudolls.

Choteau soils are associated with Dennis, Okemah, and Taloka soils. Dennis soils are in slightly higher positions than Choteau soils and have an argillic horizon within 16 inches of the surface. Okemah soils are in slightly lower positions and have an argillic horizon that has dominant matrix chroma of 1 or 2. Taloka soils are in lower positions and have an abrupt textural change between the A2 horizon and B2t horizon.

Typical pedon of Choteau loam, 1 to 3 percent slopes; about 7 miles south of Webbers Falls, about 1,500 feet north and 600 feet west of the southeast corner of sec. 8, T. 12 N., R. 19 E.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable; common fine and medium roots; medium acid; gradual wavy boundary.

A2—10 to 24 inches; grayish brown (10YR 5/2) loam; weak fine granular structure; very friable; common fine and medium roots; strongly acid; clear wavy boundary.

B1—24 to 36 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine subangular blocky structure; very firm; strongly acid; gradual wavy boundary.

B21t—36 to 46 inches; mottled gray (10YR 5/1), yellowish brown (10YR 5/6), yellowish red (5YR 4/6), and grayish brown (10YR 5/2) clay loam; moderate medium blocky structure; very firm; slightly acid; gradual wavy boundary.

B22t—46 to 62 inches; coarsely mottled yellowish brown (10YR 5/8), gray (10YR 5/1), yellowish red (5YR 5/6), and grayish brown (10YR 5/2) clay loam; weak medium and coarse blocky structure; very firm; slightly acid.

The solum is more than 60 inches thick. The A horizon ranges from 16 to 30 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Reaction ranges from slightly acid to strongly acid.

The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. The texture is loam or silt loam, and the reaction ranges from medium acid to very strongly acid.

The B1 horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The texture is silty clay loam or clay loam, and the reaction is medium acid or strongly acid.

The upper part of the B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma 3 to 6, or it is mottled in shades of gray, red, and brown. The texture is silty clay loam, clay loam, silty clay, or clay. Reaction ranges from slightly acid to strongly acid. The lower part of the B2t horizon is coarsely mottled in shades of gray, red, and brown. The texture is silty clay loam, clay loam, silty clay, or clay. Reaction ranges from medium acid to mildly alkaline.

Coweta Series

The Coweta series consists of shallow, well drained and somewhat excessively drained, moderately permeable soils on uplands. These soils are very gently sloping to strongly sloping. They formed in loamy residuum weathered from sandstone of Pennsylvanian age (fig. 14). Slopes are 1 to 12 percent. Soils of the Coweta series are loamy, siliceous, thermic, shallow Typic Hapludolls.

Coweta soils are associated with Bates and Dennis soils. Bates and Dennis soils are in lower positions than Coweta soils. These soils are deeper and have an argillic horizon.

Typical pedon of Coweta fine sandy loam, 5 to 12 percent slopes; about 4 miles south and 5 miles east of Muskogee in a woodland pasture, about 2,600 feet east and 600 feet south of the northwest corner of sec. 15, T. 14 N., R. 19 E.

A1—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam; moderate fine granular structure; friable; slightly sticky; few gravel fragments; common medium and fine roots; slightly acid; gradual wavy boundary.

B2—8 to 16 inches; brown (10YR 4/3) fine sandy loam; moderate medium subangular blocky structure; firm; slightly sticky; common fine roots; 15 percent, by volume, sandstone fragments 2 mm to 76 mm in diameter; medium acid; abrupt wavy boundary.

Cr—16 to 20 inches; strong brown (7.5YR 5/8) soft sandstone; fractured at 1 to 2 foot intervals with small amounts of soil material in cracks.

The solum ranges in thickness from 10 to 20 inches. Reaction is slightly acid or medium acid throughout the solum.

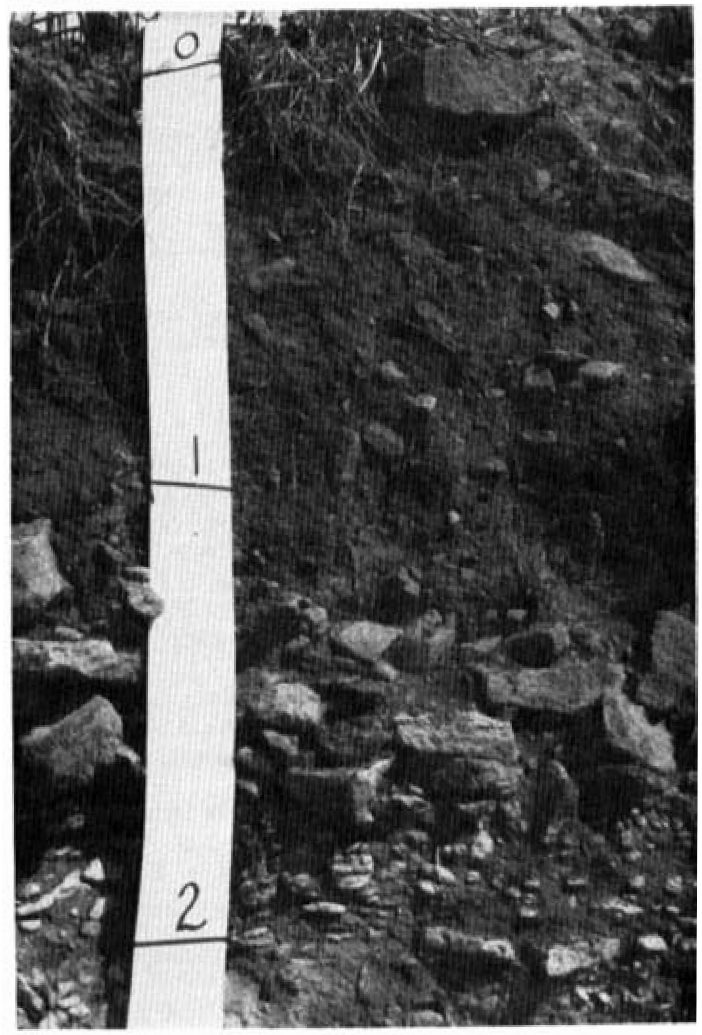


Figure 14.—Coweta fine sandy loam, 5 to 12 percent slopes, has sandstone fragments throughout the solum. (Scale is in feet.)

The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 or 3. The texture is fine sandy loam. Coarse fragments 2 to 76 millimeters in diameter make up 2 to 20 percent of the volume.

The B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4; or it has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. The texture is fine sandy loam or loam or their gravelly counterparts. Coarse fragments 2 to 76 millimeters in diameter make up 5 to 20 percent of the volume.

The Cr horizon is soft sandstone. Some pedons have hard sandstone below a depth of 24 inches.

Cupco Series

The Cupco series consists of deep, somewhat poorly drained, moderately slowly permeable soils that formed in loamy alluvial sediment. These soils are on nearly level, forested flood plains along Dirty Creek. A perched high water table is at a depth of 0.5 foot to 2 feet during the winter and spring. Slopes range from 0 to 1 percent. Soils of the Cupco series are fine-silty, siliceous, thermic Aeric Ochraqualfs.

Cupco soils are associated with Lightning and Verdigris soils. Lightning soils have over 35 percent clay in the control section. Verdigris soils are well drained and have a mollic epipedon.

Typical pedon of Cupco silt loam, occasionally flooded; 900 feet west and 1,000 feet north of the southeast corner of sec. 34, T. 13 N., R. 17 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; medium acid; clear smooth boundary.

A12—6 to 14 inches; dark brown (10YR 4/3) silt loam; few medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; medium acid; clear wavy boundary.

B21t—14 to 25 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; few thin patchy clay films on faces of peds; few fine black concretions; medium acid; gradual wavy boundary.

B22t—25 to 45 inches; dark grayish brown (10YR 4/2) silty clay loam; few medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; moderate medium and fine subangular blocky structure; friable; many fine pores; few brittle peds; thin patchy clay films on faces of peds and in pores; few fine soft masses and fine black concretions; medium acid; gradual smooth boundary.

B3—45 to 75 inches; light brownish gray (10YR 6/2) silty clay loam; few medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; few brittle yellowish brown peds; few thin clay films on faces of peds and in pores; few vertical pockets and streaks of gray (10YR 5/1) silty clay loam; medium acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Where the moist value is 3.5 or less, the dry value is 6. Reaction is medium acid to very strongly acid.

The B21t horizon has hue of 10YR, value of 3 to 6, and chroma of 2 or 3. It has mottles in shades of brown or gray. The texture is silty clay loam. Reaction ranges from slightly acid to very strongly acid.

The B22t horizon has hue of 10YR, value of 3 to 6, and chroma of 2 or 3. It has mottles in shades of brown or gray. Some pedons also have coatings that have chroma of 1. The texture is silty clay loam. Reaction is neutral to very strongly acid.

The B3 horizon has hue of 10YR, value of 4 to 6, and chroma of 2. It has mottles in shades of brown or gray. The texture is silt loam, silty clay loam, or clay loam. Reaction is neutral to strongly acid. Some pedons have coatings that have chroma of 1.

Dennis Series

The Dennis series consists of deep, moderately well drained, slowly permeable soils that formed in material weathered from shales. These soils are nearly level to moderately sloping and are on uplands. A perched high water table is at a depth of 2 or 3 feet during winter and spring. Slopes are 0 to 8 percent. Soils of the Dennis series are fine, mixed, thermic Aquic Paleudolls.

Dennis soils are associated with Bates, Choteau, Coweta, Okemah, Parsons, Stigler, Taloka, and Woodson soils. Bates and Coweta soils are in higher positions that Dennis soils, and the other soils are lower. Bates soils have a fine-loamy control section and have sandstone within 40 inches of the surface. Choteau, Stigler, and Taloka soils have an A horizon more than 16 inches thick. In addition, Stigler soils do not have a mollic epipedon. Coweta soils have sandstone within 20 inches of the surface. Okemah soils have a black or very dark brown A horizon that has distinct mottles in the lower part. Parsons soils do not have a mollic epipedon and have an abrupt textural change from the A horizon to the B horizon. Woodson soils have an abrupt textural change from the A horizon to the B horizon and are gray throughout the solum.

Typical pedon of Dennis silt loam, 1 to 3 percent slopes; 550 feet south and 100 feet east of the northwest corner of sec. 36, T. 15 N., R. 15 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; slightly acid; gradual smooth boundary.

A12—7 to 14 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; slightly acid; gradual smooth boundary.

B1—14 to 24 inches; brown (10YR 4/3) silty clay loam; few fine faint strong brown mottles; moderate medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21t—24 to 40 inches; brown (10YR 5/3) clay; many medium distinct red (2.5YR 4/6) or strong brown (7.5YR 5/8) mottles and common medium distinct dark grayish brown (10YR 4/2) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—40 to 55 inches; light olive brown (2.5Y 5/6) clay; many coarse distinct gray (10YR 6/1) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—55 to 65 inches; coarsely mottled yellowish brown (10YR 5/6) and gray (10YR 6/1) clay; weak coarse blocky structure; very firm; thin patchy clay films on faces of peds; mildly alkaline.

The solum is more than 60 inches thick. The A horizon is 10 to 15 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Reaction is mainly strongly acid or medium acid but ranges from strongly acid to slightly acid or neutral where lime has been added.

The B1 horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. It is silty clay loam or clay loam and is strongly acid or medium acid.

The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It has mottles in shades of brown, yellow, gray, or red. Mottles that have chroma of 1 or 2 are in the upper 20 inches of the argillic horizon. The texture is silty clay, clay, or silty clay loam and ranges from strongly acid to slightly acid.

The B3 horizon is coarsely mottled in shades of red, gray, yellow, or brown. The texture is silty clay loam, clay loam, silty clay, or clay. Reaction ranges from medium acid to mildly alkaline.

Enders Series

The Enders series consists of deep, well drained, very slowly permeable soils that form in thin deposits of loamy colluvial material and clayey residuum weathered from shale (fig. 15). These soils are predominantly moderately steep. They are on crests and side slopes of dissected plateaus and mountains. Slopes are about 15 percent but range from 8 to 30 percent on hillsides. Soils of the Enders series are clayey, mixed, thermic Typic Hapludults.

Enders soils are associated with Endsaw, Hector, Linker, Oktaha, Shermore, and Shidler soils. Endsaw soils occur at a higher elevation than Enders soils and have a thicker A horizon. Hector soils are intermingled with the Enders soils, do not have an argillic horizon, and are shallow over sandstone. Linker soils are on

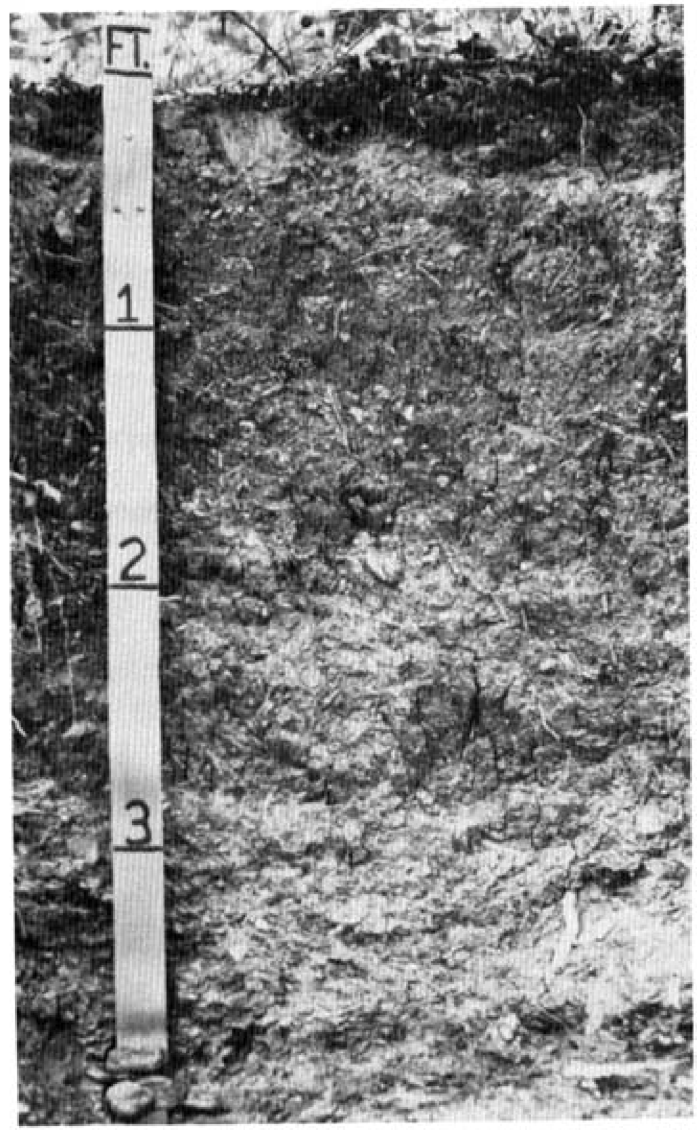


Figure 15.—The Enders soil in an area of Enders-Linker-Hector association, moderately steep, has a loam surface layer and a clay subsoil.

lower side slopes and have as fine-loamy argillic horizon. Oktaha soils are less than 40 inches deep and have less than 35 percent clay in the upper 20 inches of the argillic horizon. Shermore soils are on lower slopes and have a fine-loamy argillic horizon that has a fragipan. Shidler soils are in adjacent areas and are shallow over limestone.

Typical pedon of Enders loam in an area of Enders-Linker-Hector association, moderately steep; about 4.5 miles west and 4 miles north of Webbers Falls, 1,600 feet east and 300 feet south of the northwest corner of sec. 32, T. 13 N., R. 20 E.

A11—0 to 3 inches; very dark brown (10YR 2/2) loam; moderate fine granular structure; very friable; common fine, medium, and coarse roots; by volume, 5 percent sandstone fragments more than 3 inches in diameter and 5 percent sandstone fragments less than 3 inches in diameter; slightly acid; clear smooth boundary.

A12—3 to 6 inches; strong brown (7.5YR 5/6) loam; weak fine granular structure; very friable; common medium and fine roots; by volume, 5 percent sandstone fragments more than 3 inches in diameter and 5 percent sandstone fragments less thah 3 inches in diameter; very strongly acid; clear smooth boundary.

B21t—6 to 26 inches; red (2.5YR, 4/8) clay; moderate medium blocky structure firm; few fine roots; clay films on faces of peds; very strongly acid; gradual wavy boundary.

B22t—26 to 45 inches; mottled red (2.5YR 5/6) (60 percent) and reddish brown (5YR 5/3) (40 percent) clay; weak medium blocky structure; very firm; few fine roots; very strongly acid; gradual smooth boundary.

B3—45 to 58 inches; mottled weak red (2.5YR 5/2) (60 percent) and red (2.5YR 5/6) (40 percent) clay; weak medium blocky structure; very firm; continuous clay films on faces of peds; very strongly acid; clear smooth boundary.

Cr—58 to 72 inches; gray (5YR 5/1) laminar shale; common coarse prominent red (2.5YR 4/6) mottles; extremely acid.

The solum ranges in thickness from 32 to 59 inches, and depth to shale ranges from 40 inches to more than 60 inches. Reaction is strongly acid or very strongly acid throughout the solum except where lime has been added. Coarse fragments make up to 15 percent, by volume, of the A horizon.

The A11 horizon is 1 to 3 inches thick. It has hue of 10YR, value of 2 to 4, and chroma of 2 or 3. The texture is predominantly loam, but some areas are very fine sandy loam, fine sandy loam, or silt loam.

The A12 horizon is 2 to 5 inches thick. It has hue of 7.5YR or 10YR, value of 4 or 5, and chroma or 3 to 6. The texture is very fine sandy loam, fine sandy loam, silt loam, or loam.

The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 6 to 8. The lower part of this horizon can be mottled in shades of brown, red, or gray. The texture is mainly silty clay or clay. In some pedons, the upper part of this horizon is silty clay loam.

The B3 horizon is mottled in shades of red, brown, and gray. Some pedons do not have gray mottles. The texture is silty clay or clay.

The Cr horizon is gray to light gray weathered laminated shale that has mottles in shades of red. This extremely acid shale grades to hard shale bedrock.

Endsaw Series

The Endsaw series consists of deep, well drained, slowly permeable soils that formed in a thin layer of loamy colluvial material and clayey residuum weathered from shale. These soils are on moderately steep to steep, convex side slopes of uplands. Slopes range from 12 to 30 percent. Soils of the Endsaw series are clayey, mixed, thermic Typic Hapludults.

Endsaw soils are associated with Enders, Hector, and Linker soils. Enders soils are on the same landscapes, but they have an A horizon that is up to 8 inches thick. Hector and Linker soils are on ridges and side slopes. Hector soils are shallow over sandstone, and Linker soils are fine-loamy.

Typical pedon of Endsaw stony fine sandy loam, in an area of Endsaw-Hector association, steep; about 2,000 feet south and 1,400 feet west of the northeast corner of sec. 16, T. 10 N., R. 19 E.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) stony fine sandy loam; weak fine granular structure; very friable; 20 percent, by volume, sandstone gravel and cobbles; few stones; medium acid; clear smooth boundary.

A2—4 to 9 inches; brown (10YR 5/3) stony fine sandy loam; weak fine granular structure; very friable; 20 percent, by volume, sandstone gravel and cobbles; few stones; medium acid; clear smooth boundary.

B21t—9 to 22 inches; yellowish red (5YR 5/6) clay; moderate medium blocky structure; very firm; thick continuous clay films on faces of peds; few fine fragments of sandstone; very strongly acid; clear wavy boundary.

B22t—22 to 32 inches; yellowish red (5YR 5/6) clay; many medium prominent reddish yellow (5YR 6/8) mottles; moderate medium blocky structure; very firm; thick continuous clay films on faces of peds; few fine fragments of sandstone; very strongly acid; clear smooth boundary.

B3—32 to 42 inches; mottled yellowish red (5YR 5/6) and gray (10YR 5/1) clay; weak coarse blocky structure; very firm; few thin clay films on faces of peds; very strongly acid; gradual wavy boundary.

Cr—42 to 60 inches; olive gray (5Y 5/2) and gray (10YR 5/1) soft shale; slightly acid; tilted 10 degrees from the horizontal.

Thickness of solum and depth to shale range from 30 to 60 inches. The A horizon ranges in thickness from 9 to 20 inches.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Fragments of sandstone from 2 to 76 millimeters in diameter make up 5 to 20 percent, by volume. Fragments of sandstone from 76 millimeters to 25 centimeters in diameter make up to 10 percent, by

volume, and stones make up to 5 percent. Reaction is medium acid or strongly acid.

The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. This horizon is similar to the A1 horizon in texture, content of coarse fragments, and reaction.

The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 6 to 8. In some places, this horizon has mottles in shades of yellow, red, and brown, or gray in the lower part. The texture is silty clay or clay. Fragments of sandstone from 2 to 76 millimeters in diameter make up to 10 percent, by volume. Fragments of sandstone from 76 millimeters to 25 centimeters make up to 5 percent, by volume. Reaction is very strongly acid or strongly acid.

The B3 horizon has hue of 2.5YR, 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 1 to 6, or it is mottled in shades of brown, red, or gray. The texture, coarse fragments, and reaction are similar to those of the B2t horizon.

The Cr horizon is grayish or yellowish shale that is tilted from 0 to 20 degrees from horizontal. Reaction ranges from slightly acid to very strongly acid.

Eram Series

The Eram series consists of moderately deep, moderately well drained, slowly permeable soils. These soils are moderately sloping to moderately steep and are on uplands. They formed in residuum weathered from shale. A perched high water table is at a depth of 2 to 3 feet in the winter and spring. Slopes range from 5 to 15 percent. Soils of the Eram series are fine, mixed, thermic Aquic Argiudolls.

The Eram soils are associated with Bates, Coweta, and Dennis soils. Bates soils are in nearby areas and have a fine-loamy control section. Coweta soils are intermingled with Eram soils and are shallow over sandstone. Dennis soils are in lower positions and have a solum of 60 inches or more thick.

Typical pedon of Eram silt loam, in an area of Eram-Coweta-Rock outcrop association, strongly sloping; 2,000 feet north and 450 feet east of the southwest corner of sec. 34, T. 13 N., R. 15 E.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine and medium granular structure; friable; few fine siltstone fragments; medium acid; clean smooth boundary.

B21t—10 to 14 inches; dark grayish brown (2.5Y 4/2) clay; weak fine blocky structure; very firm; clay films on faces of peds; neutral; smooth gradual boundary.

B22t—14 to 20 inches; olive brown (2.5Y 4/4) clay; moderate fine and medium blocky structure; very firm; clay films on faces of peds; neutral; gradual boundary.

B3—20 to 30 inches, olive brown (2.5Y 4/4) clay; few fine faint gray mottles; weak medium blocky structure; very firm; clay films on faces of peds; neutral; gradual smooth boundary.

Cr—30 to 40 inches; olive gray shale; neutral.

Thickness of the solum and depth to shale are 20 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3, and chroma of 2 or 3. Fragments of sandstone 2 to 76 millimeters in diameter make up to 10 percent of the volume. Reaction is slightly acid or medium acid.

The B2t horizon has hue of 5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 4. Grayish mottles are within a depth of 16 inches in pedons that have chroma of 3 or 4. The texture is clay loam, silty clay loam, silty clay, or clay. Reaction is strongly acid to neutral.

The B3 horizon is similar to the B2t horizon in color, texture, and reaction except the color in some pedons has value 1 or 2 units higher than that of the B2t horizon.

The Cr horizon ranges from neutral to moderately alkaline.

Garton Series

The Garton series consists of deep, moderately well drained, slowly permeable soils on low terraces of flood plains on the Arkansas River. These soils are nearly level. They formed in silty alluvium. A perched high water table is at a depth of 2 to 3 feet during winter and spring. Slopes are 0 to 1 percent. Soils of the Garton series are fine, mixed, thermic Aquic Argiudolls.

Garton soils are on the same landscape with Caspiana, Mason, and Muldrow soils. Caspiana and Mason soils are in higher positions than Garton soils and have less than 35 percent clay in the control section. Muldrow soils are in lower positions and are somewhat poorly drained and gleyed in the control section.

Typical pedon of Garton silt loam, rarely flooded; 350 feet east and 1,850 feet north of the southwest corner of sec. 23, T. 12 N., R. 20 E.

Ap—0 to 6 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—6 to 11 inches; dark brown (7.5YR 3/2) silt loam; weak medium subangular blocky structure parting to weak fine granular; friable; few worm cases; neutral; clear smooth boundary.

B1—11 to 23 inches; dark brown (7.5YR 4/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few thin clay films on faces of peds; few worm cases; neutral; gradual smooth boundary.

B2t—23 to 55 inches; dark brown (7.5YR 4/4) silty clay loam; few fine faint brown mottles; moderate medium prismatic structure parting to strong fine subangular blocky; firm; thin nearly continuous clay

films on faces of peds; few fine black concretions; neutral; clear smooth boundary.

B3—55 to 70 inches; reddish brown (5YR 4/4) silty clay loam; few fine faint dark gray (10YR 4/1) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; thin patchy clay films on faces of peds; few fine black concretions; mildly alkaline.

The solum ranges in thickness from 60 to 80 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2. Reaction is medium acid to neutral.

The B1 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 or 2. It has mottles in shades of red or brown. The texture is silty clay loam or clay loam. Reaction is medium acid to neutral.

The B2t horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It has mottles in shades of red and brown. The texture is silty clay loam, clay loam, silty clay, or clay. Reaction is slightly acid to mildly alkaline.

The B3 horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. Most pedons have mottles in shades of red, brown, or gray. The texture is clay loam or silty clay loam. Reaction is neutral or mildly alkaline.

Glenpool Series

The Glenpool series consists of deep, somewhat excessively drained, rapidly permeable soils that formed in material weathered from sandy aeolian deposits (fig. 16). These nearly level to strongly sloping soils are on uplands. Slopes range from 0 to 12 percent. Soils of the Glenpool series are sandy, siliceous, thermic Psammentic Paleudalfs.

Glenpool soils are associated with Kamie and Larton soils. The associated soils are generally in higher positions than the Glenpool soils and have a more clayey control section.

Typical pedon of Glenpool fine sand, 0 to 3 percent slopes; 200 feet north and 100 feet east of the southwest corner of sec. 4, T. 13 N., R. 20 E.

A1—0 to 6 inches; brown (7.5YR 4/4) fine sand; single grained; loose; many fine and medium roots; strongly acid; gradual smooth boundary.

A2—6 to 52 inches; strong brown (7.5YR 5/6) fine sand; single grained; loose; many fine and medium roots; strongly acid; diffuse wavy boundary.

A2&B21t—52 to 76 inches; reddish yellow (7.5YR 6/6) loamy fine sand (A2); single grained; loose; lamellae of yellowish red (5YR 4/6) fine sandy loam (B21t); wavy and discontinuous 0.25 to 0.5 inch thick and 1.0 inch to 3.0 inches apart; clay bridges between sand grains in lamellae; common fine and medium roots; strongly acid; diffuse wavy boundary.

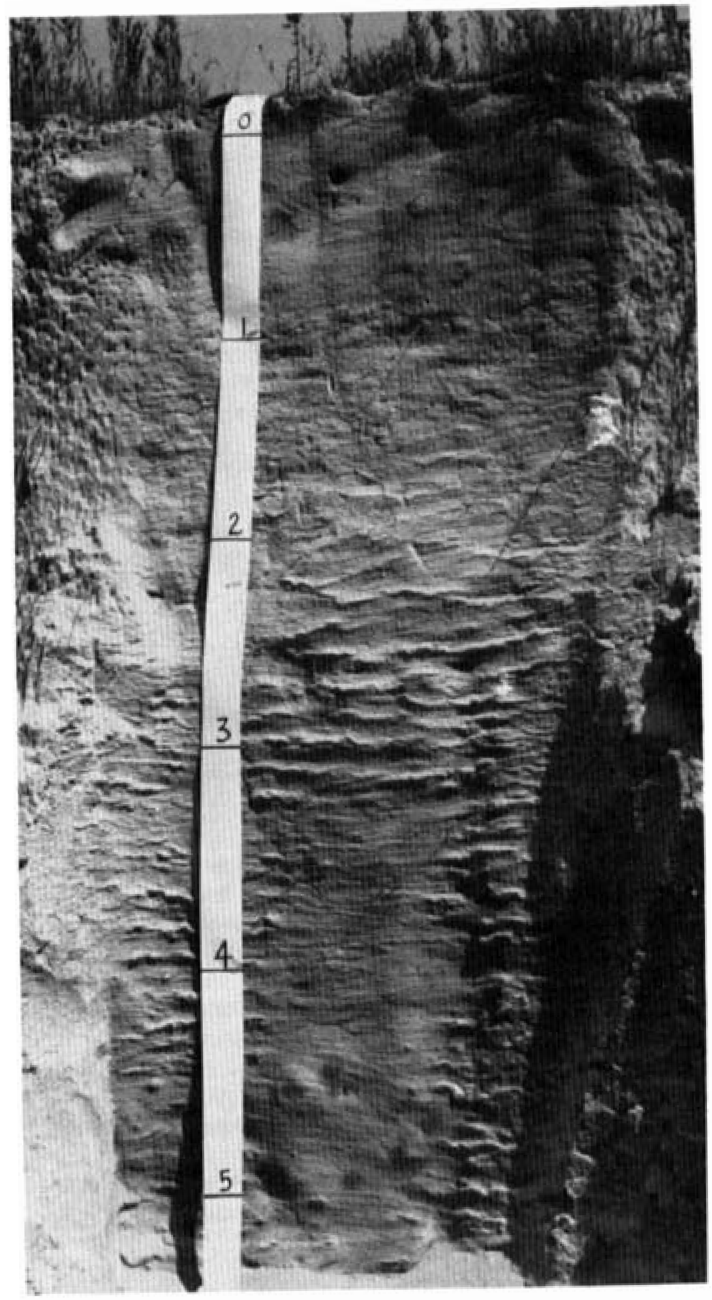


Figure 16.—Glenpool soils are dominantly fine sand and loamy fine sand throughout. (Scale is in feet.)

A2&B22t—76 to 99 inches; reddish yellow (7.5YR 6/6) loamy fine sand (A2); single grained; loose; lamellae of yellowish red (5YR 4/6) fine sandy loam (B22t); wavy and discontinuous 0.75 inch to 1.5 inches thick and 1.0 inch to 2.0 inches apart; clay bridges between sand grains in lamellae; medium acid.

The solum is more than 60 inches thick. Combined thickness of the A1 and A2 horizons ranges from 20 to 60 inches.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. Reaction is strongly acid to slightly acid.

The A2 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6. The texture is loamy fine sand or fine sand. Reaction ranges from strongly acid to slightly acid.

The A2 part of the A2&B2t horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. The B2t part of the A2&B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Lamellae range in thickness from 0.25 inch in the upper part of the horizon to 1.5 inches in the lower part. They range from 1 inch to 12 inches apart, but are commonly closer than 4 inches apart. The combined thickness of the lamellae is more than 6 inches. This horizon is very strongly acid to medium acid.

Hector Series

The Hector series consists of shallow, well drained, moderately rapidly permeable soils formed in residuum from sandstone. These soils are very gently sloping to very steep. They are on ridgetops and shoulder slopes. Hector soils do not have a high water table within a depth of 6 feet. Slcpes range from 1 to as much as 50 percent. Soils in the Hector series are loamy, siliceous, thermic Lithic Dystrochrepts.

Hector soils are associated with Enders, Endsaw, Linker, Oktaha, Shidler, and Spiro soils. Enders and Endsaw soils are on lower slopes than Hector soils and are deeper and have a clayey argillic horizon. Linker and Oktaha soils are on lower slopes, are moderately deep and are in a fine-loamy family. Shidler soils are on adjacent slopes and are shallow over limestone.

Typical pedon of Hector fine sandy loam, in an area of Enders-Linker-Hector association, moderately steep; 190 feet south and 450 feet east of the northwest corner of sec. 35, T. 10 N., R. 19 E.

A1—0 to 3 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; very friable common medium and fine roots; about 10 percent, by volume, sandstone gravel; strongly acid; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; very friable; common fine roots; about 10 percent, by volume, sandstone gravel; strongly acid; clear smooth boundary.

B2—6 to 16 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; friable; few fine roots; about 10 percent, by volume, sandstone gravel; strongly acid; abrupt irregular boundary.

R—16 to 22 inches; hard sandstone.

The solum ranges in thickness from 10 to 20 inches. Reaction ranges from slightly acid to strongly acid in the A horizon and is strongly acid or very strongly acid in the B horizon. The solum contains from 0 to 35 percent, by volume, sandstone gravel and from 0 to 35 percent, by volume, stones. The texture is fine sandy loam, loam, stony fine sandy loam, or stony loam.

The A1 horizon is 1 to 3 inches thick. It has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3.

The A2 horizon is 3 to 7 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2 horizon is 4 to 10 inches thick. It has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6, or hue of 5YR, value of 4, and chroma of 4 to 6.

Kamie Series

The Kamie series consists of deep, well drained, moderately permeable soils formed in deep deposits of loamy and sandy sediment. These soils are very gently sloping to moderately sloping and are on high river terraces. Slopes range from 1 to 8 percent. Soils of the Kamie series are fine-loamy, mixed, thermic Typic Paleudalfs.

Kamie soils are associated with Glenpool and Larton soils. Glenpool and Larton soils are generally in lower positions than Kamie soils and have an A horizon more than 20 inches thick.

Typical pedon of Kamie fine sandy loam, 3 to 5 percent slopes; in a native grass hay meadow, about 1 mile north and 1 mile west of Briartown, 1,580 feet west and 2,560 feet south of the northeast corner of sec. 26, T. 10 N., R. 19 E.

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam; weak fine granular structure; friable; common fine and medium roots; slightly acid; abrupt wavy boundary.

A2—7 to 11 inches; brown (7.5YR 5/4) fine sandy loam; moderate fine granular structure; friable; common fine roots; medium acid; clear smooth boundary.

B21t—11 to 20 inches; red (2.5YR 4/6) sandy clay loam; weak fine subangular blocky structure; friable; few fine roots; clay films on faces of peds; medium acid; clear wavy boundary.

B22t—20 to 50 inches; red (2.5YR 4/8) clay loam, moderate medium subangular blocky structure; firm; few fine roots; nearly continuous clay films on faces of peds; medium acid; gradual irregular boundary.

B3—50 to 65 inches; red (2.5YR 4/8) fine sandy loam; many medium prominent light yellowish brown (10YR 6/4) streaks; moderate fine granular structure; friable; few pockets of clean sand grains; medium acid.

The solum is at least 60 inches thick.

The Ap or A1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4.

The A2 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6. The texture generally is fine sandy loam, but in some pedons, it is loamy fine sand. Reaction ranges from slightly acid to strongly acid.

The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8. The texture is sandy clay loam or clay loam. Reaction ranges from slightly acid to strongly acid.

The B3 horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 or 8. The texture is fine sandy loam, loam, or sandy clay loam. Reaction is slightly acid to very strongly acid. Skeletons or pockets of clean sand grains make up 1 to 3 percent of the volume.

Kanima Series

The Kanima series consists of deep, well drained, moderately permeable soils formed in excavated loamy material weathered from sandstone and shale deposited by strip mine operations. These soils are gently sloping to steep. They are on spoil banks adjacent to strip pits on uplands. Slopes are 3 to 30 percent. Soils of the Kanima series are loamy-skeletal, mixed, nonacid, thermic Udalfic Arents.

Kanima soils are associated with Parsons and Taloka soils. Parsons and Taloka soils are intermingled with the Kanima soils and have an argillic horizon.

Typical pedon of Kanima shaly silty clay loam, 3 to 30 percent slopes; about 2 miles north and 3 miles east of Porum, 2,000 feet east and 3,100 feet south of the northwest corner of sec. 30, T. 11 N., R. 20 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) shaly silty clay loam; moderate medium granular structure; firm; 15 percent, by volume, shale fragments 2 to 76 mm in diameter; 3 percent fine coal fragments; slightly acid; gradual wavy boundary.

C—4 to 72 inches; olive brown (2.5Y 4/4) very shaly silty clay loam; massive; very firm; 50 percent of the upper part and 70 percent of the lower part, by volume, shale fragments 2 to 76 mm in diameter; 5 percent fine and medium fragments of coal; few fragments of silty clay loam with patchy clay films; medium acid.

Depth to bedrock is more than 6 feet.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. The texture is generally shaly silty clay loam, but in some areas, it is shaly clay loam. Coarse fragments 2 to 76 millimeters in diameter range from 15 to 35 percent, by volume. Reaction ranges from medium acid to mildly alkaline.

The C horizon has pockets of fragments of an argillic horizon and mollic horizon similar to associated soils. It has hue of 2.5Y or 5Y, value of 3 or 4, and chroma of 2 to 4. The texture is very shaly clay loam or very shaly silt clay loam. Coarse fragments 2 to 76 millimeters in diameter make up from 35 to 80 percent of the volume. Reaction ranges from medium acid to mildly alkaline.

Keo Series

The Keo series consists of deep, well drained, moderately permeable soils on flood plains of the Arkansas River. These soils are nearly level. They formed in loamy alluvial deposits. Slopes are 0 to 1 percent. Soils of the Keo series are coarse-silty, mixed, thermic Dystric Fluventic Eutrochrepts.

Keo soils are on the same landscape with the Coska soils. Latanier, Norwood, Roebuck, and Roxana soils are on lower terraces adjacent to Keo soils. Choska soils have a mollic epipedon. Latanier and Roebuck soils have a mollic epipedon and more than 35 percent clay in the control section. Norwood soils have a fine-silty control section. Roxana soils have bedding planes at a depth of less than 40 inches.

Typical pedon of Keo very fine sandy loam, rarely flooded; 2.300 feet east and 1,700 feet north of the southwest corner of sec. 30, T. 12 N., R. 21 E.

Ap—0 to 9 inches; dark reddish brown (5YR 3/4) very fine sandy loam; weak fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

B21—9 to 24 inches dark reddish brown (5YR 3/4) silt loam; moderate medium prismatic structure parting to moderate medium subangular blocky; very friable; common fine roots; common worm casts; mildly alkaline; clear smooth boundary.

B22—24 to 41 inches; reddish brown (5YR 4/4) very fine sandy loam; weak medium prismatic structure parting to weak medium subangular blocky; very friable; common fine roots; common worm casts; mildly alkaline; gradual smooth boundary.

C—41 to 71 inches; reddish brown (5YR 4/4) very fine sandy loam; reddish brown (5YR 4/4) moist; massive; very friable; faint bedding planes and thin strata of darker material; calcareous at 46 inches; mildly alkaline.

The solum is 35 to about 50 inches thick. Depth to carbonates is more than 40 inches.

The Ap horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4, or hue of 5YR, value of 3, and chroma of 4. Reaction is neutral or mildly alkaline.

The B2 horizon has hue of 5YR, value of 3 to 5, and chroma of 3 to 6. The texture is very fine sandy loam, loam, or silt loam. Reaction is neutral or mildly alkaline.

The C horizon has colors similar to those of the B horizon. The texture is stratified silt loam, very fine sandy loam, silty clay loam, and loamy fine sand. Reaction is moderately alkaline and may or may not be calcareous.

Kiomatia Series

The Kiomatia series consists of deep, well drained, rapidly permeable soils formed in sandy alluvial sediment that has strata of finer sediment. These soils are nearly level or very gently sloping and are on flood plains. They are subject to flooding. An apparent high water table is at a depth of 3 to 5 feet during winter, spring, and summer. Slopes are 0 to 2 percent. Soils of the Kiomatia series are sandy, mixed, thermic Typic Udifluvents.

Kiomatia soils are associated with Choska, Roxana, and Severn soils. These associated soils are higher in elevation than the Choska soils and have a coarse-silty control section.

Typical pedon of Kiomatia loamy fine sand, frequently flooded; 3,500 feet west and 2,000 feet south of the northeast corner of sec. 30, T. 15 N., R. 20 E.

A—0 to 10 inches; brown (7.5YR 4/4) loamy fine sand; weak fine granular structure; very friable; common fine roots; calcareous, mildly alkaline; gradual wavy boundary.

C—10 to 62 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose; few thin strata of fine sandy loam and fine sand; calcareous, mildly alkaline.

The soil is more than 60 inches thick. Reaction ranges from slightly acid to moderately alkaline.

The A horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4. The texture is fine sandy loam or loamy fine sand.

The C horizon has hue of 7.5YR or 5YR, value of 4 to 8, and chroma of 3 to 6. The texture is loamy fine sand or fine sand that has thin strata of fine sandy loam, loam, or silt loam. The strata is 0.25 to 1.0 inch thick and about 6 to 20 inches apart.

Larton Series

The Larton series consists of deep, well drained, moderately permeable soils on stream terraces. These soils are nearly level to strongly sloping. They formed in material weathered from loamy and sandy aeolian and alluvial deposits. Slopes are 0 to 12 percent. Soils of the Larton series are loamy, siliceous, thermic Arenic Paleudalfs.

Larton soils are associated with Glenpool and Kamie soils. Glenpool soils are on the same landscape or in lower positions than Larton soils and have a sandy control section. Kamie soils are in higher positions and have a surface layer less than 20 inches thick.

Typical pedon of Larton loamy fine sand, 0 to 3 percent slopes; 1,600 feet north and 1,550 feet east of the southwest corner of sec. 5, T. 13 N., R. 20 E.

Ap—0 to 14 inches; brown (7.5YR 5/4) loamy fine sand; weak fine granular structure; loose; common fine roots; slightly acid; clear smooth boundary.

A2—14 to 28 inches; brown (7.5YR 5/4) loamy fine sand; single grained; loose; common fine roots; slightly acid; clear smooth boundary.

B21t—28 to 44 inches; yellowish red (5YR 4/6) sandy clay loam; weak coarse prismatic structure parting to weak fine subangular blocky; friable; few fine roots; thin patchy clay films on faces of peds; clay bridging between sand grains; medium acid; gradual smooth boundary.

B22t—44 to 69 inches; yellowish red (5YR 5/8) fine sandy loam; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; few fine roots; clay bridging between sand grains; medium acid.

The solum is more than 60 inches thick.

The A or Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. Reaction is slightly acid to strongly acid.

The A2 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is slightly acid to strongly acid. Combined thickness of the A1 and A2 horizons is 20 to 40 inches.

The B2t horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 4 or 5, and chroma of 4 or 6. The texture is dominantly sandy clay loam, but it includes fine sandy loam and loam. Reaction is medium acid to very strongly acid.

Latanier Series

The Latanier series consists of deep, somewhat poorly drained, very slowly permeable soils on flood plains of the Arkansas River. These soils are nearly level. They formed in clayey alluvium underlain by loamy alluvium. Slopes are 0 to 1 percent. An apparent high water table is at a depth of 1 to 3 feet from winter to summer. Soils of the Latanier series are clayey over loamy, mixed, thermic Vertic Hapludolls.

Latanier soils are associated with Choska, Keo, Norwood, Roebuck, Roxana, and Severn soils. Choska, Keo, Roxana, and Severn soils are on slightly higher surfaces that Latanier soils and have less than 18 percent clay in the control section. Norwood soils are in similar positions but have 18 to 35 percent clay in the control section and do not have a mollic epipedon. Roebuck soils are in lower positions and do not have loamy layers above a depth of 40 inches.

Typical pedon of Latanier silty clay loam, rarely flooded; 2,300 feet east and 2,750 feet north of the southwest corner of sec. 19, T. 12 N., R. 21 E.

Ap—0 to 11 inches; dark reddish brown (5YR 3/2) silty clay loam; weak fine and medium subangular blocky structure; very firm; mildly alkaline abrupt smooth boundary.

B21—11 to 27 inches; dark reddish brown (5YR 3/4) silty clay; moderate fine subangular blocky structure; very firm; mildly alkaline; gradual smooth boundary.

B22—27 to 35 inches; dark reddish brown (5YR 3/4) silty clay; moderate medium subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

IIC—35 to 71 inches; reddish brown (5YR 4/4) loam; massive; thin strata of very fine sandy loam and silt loam; friable; calcareous, moderately alkaline.

The soil is more than 60 inches thick. Depth to contrasting texture ranges from 20 to 40 inches. Latanier soils are calcareous in some horizons between depths of 8 and 36 inches.

The A horizon has hue of 5YR, value of 3, and chroma of 2 or 3. Reaction ranges from neutral to moderately alkaline.

The B2 horizon has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 3 or 4. The texture is clay or silty clay. Reaction is mildly alkaline or moderately alkaline. Some pedons are calcareous.

The C horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4. Some pedons contain few yellowish brown mottles. This horizon is monotextured or stratified very fine sandy loam, loam, silt loam, or silty clay loam. Reaction is mildly alkaline or moderately alkaline and calcareous within a depth of 36 inches.

Lightning Series

The Lightning series consists of deep, somewhat poorly drained, very slowly permeable soils that formed in loamy and clayey sediment. These soils are on nearly level flood plains on local creeks and their tributaries. A perched high water table is at a depth of less than 2 feet during winter and spring. Slopes range from 0 to 1 percent. Soils of the Lightning series are fine, mixed, thermic Typic Ochraqualfs.

Lightning soils are associated with the Cupco, Osage, Tullahassee, and Verdigris soils. The Cupco and Osage soils are in positions similar to those of the Lightning soils. Cupco soils have a fine-silty control section, and the Osage soils have a mollic horizon and a fine control section. Tullahassee soils are on smaller streams and are coarse-loamy. Verdigris soils are near the stream channel and are fine-silty.

Typical pedon of Lightning silt loam, occasionally flooded; 1,300 feet south and 225 feet west of the northeast corner of sec. 6, T. 14 N., R. 16 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A2—7 to 14 inches; grayish brown (10YR 5/2) silt loam; few fine faint dark gray mottles; weak fine granular structure; friable; strongly acid; clear wavy boundary.

B1g—14 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct dark gray and dark yellowish brown mottles; moderate medium blocky structure; very firm; clay films on faces of peds; strongly acid; diffuse wavy boundary.

B21tg—22 to 35 inches; dark gray (10YR 4/1) silty clay; common fine distinct gray and dark yellowish brown mottles; moderate medium blocky structure; very firm; clay films on faces of peds; medium acid; gradual wavy boundary.

B22tg—35 to 62 inches; gray (10YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles and few fine distinct very dark gray mottles; weak coarse blocky structure; very firm; patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

Cg—62 to 80 inches; coarsely mottled dark gray (10YR 4/1) and yellowish brown (10YR 5/6) silty clay; massive; very firm; neutral.

The solum is more than 40 inches thick.

The Ap or A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction ranges from strongly acid to neutral.

The A2 horizon has value of 1 or 2 units higher than the Ap or A1 horizon. Reaction ranges from very strongly acid to slightly acid.

The B1g horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It has mottles in shades of gray, brown, or red. The texture is silt loam or silty clay loam. Reaction ranges from very strongly acid to slightly acid.

The B21tg horizon has hue of 10YR, value of 3 to 6, and chroma of 1. It has mottles in shades of gray, red, or brown. The texture is silty clay loam, silty clay, or clay. Reaction ranges from very strongly acid to slightly acid.

The B22tg horizon and Cg horizon are similar to the B21tg horizon in color and texture. Reaction ranges from medium acid to mildly alkaline.

Linker Series

The Linker series consists of moderately deep, well drained, moderately permeable soils that formed in loamy residuum on uplands. These soils are very gently sloping to moderately steep. They are on broad plateaus, mountaintops, and hilltops and benches. Slopes range from 1 to 20 percent. Soils of the Linker series are fine-loamy, siliceous, thermic Typic Hapludults.

Linker soils are associated with Enders, Endsaw, Hector, Oktaha, Shermore, Shidler, and Spiro soils. Enders and Endsaw soils are on lower slopes than Linker soils and have more than 35 percent clay in the upper 20 inches of the argillic horizon. Hector and Shidler soils are intermingled with Linker soils, are less than 20 inches deep to bedrock, and do not have an argillic horizon. Oktaha soils are also intermingled. They have a brownish or yellowish argillic horizon. Shermore

and Spiro soils are intermingled with Linker soils. Shermore soils have an argillic horizon that has a fragipan, and Spiro soils have a fine-silty control section.

Typical pedon of Linker fine sandy loam, 1 to 3 percent slopes; 2,600 feet west and 2,000 feet north of the southeast corner of sec. 32, T. 11 N., R. 20 E.

Ap—0 to 8 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; friable; common medium and fine roots; medium acid; gradual wavy boundary.

B1—8 to 12 inches; strong brown (7.5YR 4/6) fine sandy loam; weak fine subangular blocky structure; friable; common fine roots; medium acid; clear wavy boundary.

B2t—12 to 30 inches; red (2.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; very firm; few fine roots; strongly acid; gradual diffuse boundary.

B3—30 to 39 inches; red (2.5YR 5/6) sandy clay loam; few fine distinct strong brown mottles; weak fine subangular blocky structure; very firm; few fine roots; strongly acid; abrupt wavy boundary.

R—39 to 50 inches; stratified reddish brown (2.5YR 5/4), red (2.5YR 4/6), yellowish red (5YR 4/6), and yellowish brown (10YR 5/6) acid sandstone.

The solum ranges in thickness from 20 to 40 inches. Coarse fragments of sandstone 2 to 76 millimeters in diameter range up to 10 percent, by volume, throughout the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. Reaction is generally strongly acid, but it ranges from strongly acid to slightly acid in areas that are limed.

The B1 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 6 to 8. The texture is fine sandy loam, sandy clay loam, or loam. Reaction is generally strongly acid, but it ranges from strongly acid to medium acid in areas that are limed.

The B2t and B3 horizons have hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 to 8. The B3 horizon in most pedons has mottles in shades of red, brown, or gray. Texture of the B2t and B3 horizons is sandy clay loam, clay loam, or loam. Reaction is strongly acid or very strongly acid.

Mason Series

The Mason series consists of deep, well drained and moderately well drained, moderately slowly permeable soils. These soils are nearly level or very gently sloping. They formed in loamy alluvial material on broad, smooth terraces of flood plains of major river systems (fig. 17). Slopes range from 0 to 3 percent. Soils of the Mason series are fine-silty, mixed, thermic Typic Argiudolls.

Mason soils are associated with Caspiana, Garton, Muldrow, and Okay soils. Caspiana soils are closer to stream channels than Mason soils and have a reddish argillic horizon. Garton and Muldrow soils are generally farther from stream channels; they have a fine control section. Okay soils are on higher terraces and have a fine-loamy argillic horizon.

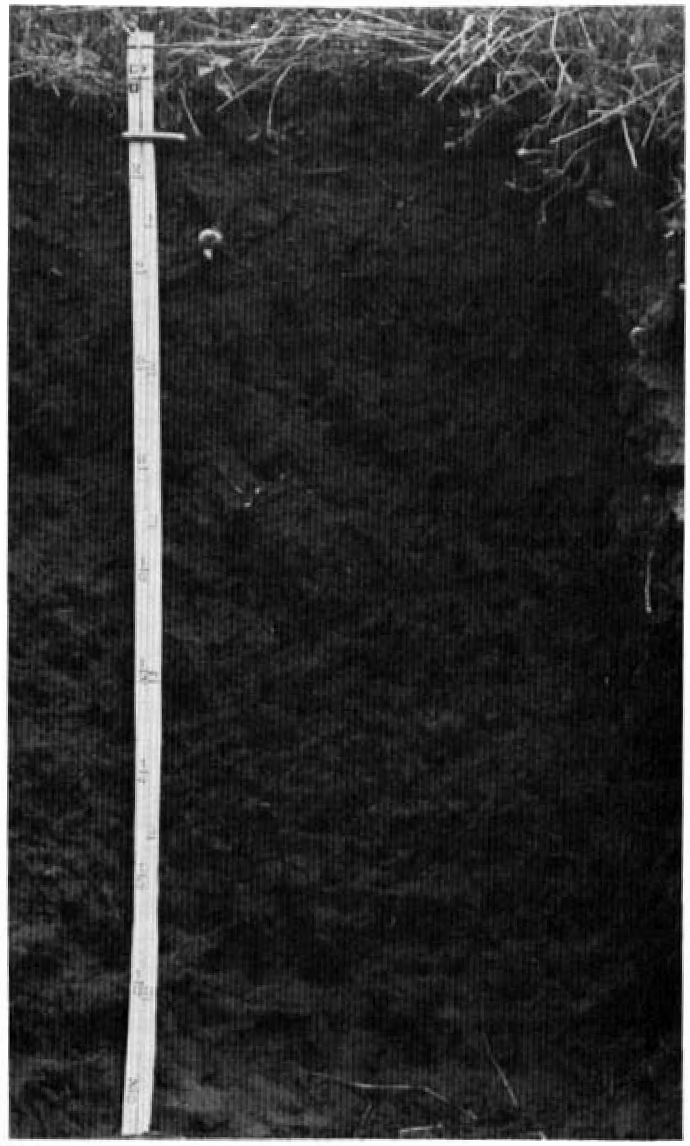


Figure 17.—The Mason soils are silt loam or silty clay loam throughout. (Scale is in centimeters and feet.)

Typical pedon of Mason silt loam, rarely flooded, 0 to 1 percent slopes; about 7 miles east of McLain, 250 feet west and 1,000 feet north of the southeast corner of sec. 23, T. 12 N., R. 20 E.

Ap—0 to 14 inches; dark brown (7.5YR 3/2) silt loam; weak medium granular structure; friable; neutral; abrupt smooth boundary.

B21t—14 to 27 inches; very dark brown (10YR 2/2) silty clay loam; moderate coarse prismatic structure parting to weak medium subangular blocky; friable; thin patchy clay films on faces of peds; few worm casts; neutral; gradual smooth boundary.

B22t—27 to 38 inches; dark brown (7.5YR 3/2) silty clay loam; moderate medium prismatic structure parting to weak medium subangular blocky; friable; thin patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B23t—38 to 50 inches; brown (7.5YR 4/4) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few thin clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—50 to 62 inches; brown (7.5YR 4/4) silty clay loam; weak medium prismatic structure; friable; neutral.

The solum ranges in thickness from 40 to 60 inches. The mollic horizon is 20 inches or more thick.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. Reaction ranges from medium acid to neutral.

The B21t horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. The texture is silty clay loam or silt loam. Reaction is slightly acid or neutral.

The B22t horizon, B23t horizon, and B3 horizon have hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. The texture is silty clay loam or silt loam. Reaction ranges from medium acid to neutral.

Some pedons have a C horizon. It has hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4. It has strata of loam, silt loam, clay loam, or silty clay loam. Reaction ranges from medium acid to neutral.

Muldrow Series

The Muldrow series consists of deep, somewhat poorly drained, very slowly permeable soils on low terraces of flood plains on the Arkansas River. These soils are nearly level. They formed in clayey alluvium. An apparent high water table is within 2 feet of the surface for short periods in the spring and fall. Slopes are 0 to 1 percent. Soils of the Muldrow series are fine, mixed, thermic Typic Argiaquolls.

Muldrow soils are associated with Caspiana, Garton, and Mason soils. These soils are in slightly higher positions than Muldrow soils, are not gleyed, and do not have an aquic moisture regime. Caspiana and Mason soils also have less than 35 percent clay in the control section.

Typical pedon of Muldrow silty clay loam, rarely flooded; 625 feet south and 4,000 feet west of the northeast corner of sec. 23, T. 12 N., R. 20 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine granular structure; few fine faint yellowish brown mottles; firm; medium acid; abrupt smooth boundary.

B21tg—10 to 27 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles: moderate fine prismatic structure parting to moderate fine subangular blocky; very firm; thin patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B22tg—27 to 47 inches; dark gray (10YR 4/1) silty clay; few fine distinct brown (7.5YR 4/4) mottles: strong medium prismatic structure parting to strong fine and medium subangular blocky; very firm; thin nearly continuous clay films on faces of peds; neutral; gradual smooth boundary.

B3g—47 to 67 inches; brown (7.5YR 4/4) silty clay loam; common medium distinct dark gray (10YR 4/1) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; very firm; thin patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

C—67 to 80 inches; brown (7.5YR 4/4) silty clay loam; common medium distinct dark gray (10YR 4/1) mottles and common fine faint strong brown mottles; massive; very firm; mildly alkaline.

The solum ranges in thickness from 60 to 80 inches.

The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. Reaction ranges from medium acid to neutral.

The B2tg horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 or 2. It has mottles in shades of brown. The texture is silty clay loam or silty clay. Reaction is slightly acid to moderately alkaline.

The B3g horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The texture is silty clay loam or silty clay. Reaction is neutral to moderately alkaline.

The C horizon has color, texture, and reaction similar to those of the B3g horizon.

Norwood Series

The Norwood series consists of deep, well drained, moderately permeable soils that formed in stratified, calcareous, loamy alluvium partly of Permian Red Bed origin. These soils are nearly level and are on flood plains along the Arkansas River. Slopes are 0 to 1 percent. Soils of the Norwood series are fine-silty, mixed (calcareous), thermic Typic Udifluvents.

Norwood soils are associated with Barge, Keo, Latanier, and Severn soils. Barge soils are on higher landscapes than Norwood soils and have fragments of a mollic horizon throughout the profile. Keo and Severn soils commonly are on higher land surfaces and have a coarse-silty control section. Latanier soils are in similar

positions farther from the stream and have a clayey over loamy control section.

Typical pedon of Norwood silt loam, rarely flooded; in a cultivated field, 1,000 feet west and 2,100 feet south of the junction of Oklahoma Highway 16 and the Muskogee-Wagner County line.

Ap—0 to 6 inches; reddish brown (5YR 4/4) silt loam; weak fine granular structure; friable; moderately alkaline; abrupt smooth boundary.

A1—6 to 10 inches; reddish brown (5YR 4/3) silt loam; weak fine subangular blocky structure; friable; moderately alkaline; clear smooth boundary.

B2—10 to 38 inches; reddish brown (5YR 4/4) silt loam; massive friable; bedding planes evident; 1.5-inch stratum of silty clay loam; calcareous, moderately alkaline; gradual wavy boundary.

C—38 to 65 inches; reddish brown (5YR 4/4) silt loam; massive; very friable; bedding planes evident; 1.5-inch stratum of silty clay loam; calcareous, moderately alkaline.

Depth to bedding planes ranges from 10 to 36 inches.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Reaction is mildly alkaline or moderately alkaline.

The B horizon has hue of 5YR, value of 4 to 6, and chroma of 3 or 4. The texture is dominantly silt loam and has strata of finer and coarser textured material. Reaction is moderately alkaline. Some pedons do not have a B horizon.

The C horizon has hue of 5YR, value of 4 to 6, and chroma of 3 to 6, or hue of 7.5YR, value of 6 or 7, and chroma of 6. The texture in the 10- to 40-inch control section commonly is silt loam or silty clay loam that has thin strata of fine sandy loam to silty clay loam. Below a depth of 40 inches, the texture ranges from fine sandy loam to clay and is stratified. In some pedons, buried horizons that have darker colors are below a depth of 40 inches.

Okay Series

The Okay series consists of deep, well drained, moderately permeable soils formed in loamy sediment on uplands. These soils are nearly level or very gently sloping. They are on broad, smooth, old river terraces from major river systems. Slopes range from 1 to 3 percent. Soils of the Okay series are fine-loamy, mixed, thermic Typic Argiudolls.

Okay soils are associated with Caspiana and Mason soils. These soils are in lower positions than Okay soils. They have less than 15 percent sand coarser than very fine sand in the upper 20 inches of the argillic horizon.

Typical pedon of Okay very fine sandy loam, 1 to 3 percent slopes; about 1 mile east and 8 miles south of Webbers Falls, 1,500 feet south and 60 feet west of the northeast corner of sec. 20, T. 15 N., R. 16 E.

A1—0 to 18 inches; dark brown (10YR 3/3) very fine sandy loam; weak fine granular structure; friable; common fine roots; slightly acid; gradual smooth boundary.

B1—18 to 26 inches; dark grayish brown (10YR 4/2) loam; weak fine blocky structure; firm; few fine roots; common fine iron concretions; common fine black bodies; medium acid; gradual wavy boundary.

B21t—26 to 45 inches; brown (7.5YR 5/4) clay loam; moderate medium blocky structure; very firm; common medium distinct grayish brown (10YR 5/2) mottles; common fine and medium iron concretions; strongly acid; gradual wavy boundary.

B22t—45 to 65 inches; brown (7.5YR 5/4) sandy clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium blocky structure; firm; strongly acid; gradual wavy boundary.

The solum ranges in thickness form 40 to 70 inches.

The A1 horizon has hue of 10YR, value of 3, and chroma of 2 or 3. Reaction ranges from medium acid to neutral.

The B1 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. The texture is clay loam or loam. Reaction is medium acid or slightly acid.

The B2t horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. The texture is sandy clay loam or clay loam. Reaction ranges from strongly acid to slightly acid.

Some pedons have a B3 horizon. It has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. The texture is sandy clay loam or loam. Reaction ranges from strongly acid to neutral.

Okemah Series

The Okemah series consists of deep, moderately well drained, slowly permeable soils that formed in residuum or colluvium weathered from shaly clay loam or clay. These soils are nearly level and are on prairie uplands. A perched high water table is at a depth of 2 to 3 feet in winter and spring. Slopes range from 0 to 1 percent. Soils of the Okemah series are fine, mixed, thermic Aquic Paleudolls.

Okemah soils are on the same landscape with Choteau, Dennis, Parsons, and Taloka soils. Choteau and Dennis soils are in slightly higher positions than the Okemah soils and do not have the dominant colors that have chroma of 1 or 2 in the matrix of the argillic horizon. Parsons and Taloka soils are in slightly lower positions and have an abrupt change in texture from the A horizon to the argillic horizon.

Typical pedon of Okemah silt loam, 0 to 1 percent slopes; about 3 miles south of Boynton, 1,400 feet north and 60 feet east of the southwest corner of sec. 12, T. 13 N., R. 15 E.

A1—0 to 8 inches; very dark brown (10YR 2/2) silt loam; moderate fine and medium granular structure; friable; common medium and fine roots; slightly acid; gradual smooth boundary.

A3—8 to 16 inches; black (10YR 2/1) silty clay loam; moderate fine and medium granular structure; firm; common fine roots; medium acid; gradual wavy boundary.

B21t—16 to 21 inches; very dark gray (10YR 3/1) silty clay loam; few fine faint grayish brown mottles; moderate fine subangular blocky structure; firm; few fine roots; clay films on faces of peds; few fine iron concretions; slightly acid; gradual smooth boundary.

B22t—21 to 42 inches; dark grayish brown (2.5Y 4/2) clay; many fine medium and coarse distinct strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and yellowish red (5YR 4/6) mottles; weak fine and medium blocky structure; firm; clay films on faces of peds; common fine iron concretions; neutral; gradual smooth boundary.

B3—42 to 65 inches; coarsely mottled yellowish red (5YR 4/6) and gray (10YR 5/1) clay; weak medium blocky structure; very firm; many fine and medium iron concretions; few medium gypsum crystals; neutral.

The solum ranges in thickness from 60 to 80 inches. The A horizon is 15 to 24 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from medium acid to neutral.

The A3 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The texture is silt loam or silty clay loam. Reaction ranges from medium acid to neutral.

The B2t horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. It has mottles in shades of gray and brown, olive, or red. The texture is silty clay loam, clay loam, or silty clay. Reaction ranges from medium acid to mildly alkaline.

The B3 horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 3 or 4, and chroma of 1 or 2; or it is coarsely mottled in hue redder than 7.5YR and chroma of more than 5 and in shades of gray. The texture is silty clay loam, silty clay, or clay. Reaction is neutral or mildly alkaline.

Oktaha Series

The Oktaha series consists of moderately deep, well drained, moderately permeable soils that formed in material weathered from loamy residuum of sandstone. These soils are on smooth, very gently sloping and gently sloping ridges on uplands. Slopes range from 1 to 5 percent. Soils of the Oktaha series are fine-loamy, siliceous, thermic Typic Hapludults.

Oktaha soils are associated with Enders, Hector, Linker, Shidler, and Spiro soils. All of the associated soils are in intermingled areas except the Enders soils, which are on side slopes of uplands with deeply intrenched drainageways. Enders soils have a fine particle-size control section, and Linker soils have a reddish argillic horizon that has lower base saturation. Hector and Shidler soils are shallow over hard bedrock, and Spiro soils have a fine-silty control section.

Typical pedon of Oktaha fine sandy loam, 1 to 3 percent slopes; 200 feet north and 280 feet west of the southeast corner of sec. 16, T. 13 N., R. 18 E.

Ap—0 to 5 inches; dark brown (10YR 3/3) fine sandy loam; weak fine granular structure; very friable; common fine and medium roots; many medium pores; medium acid; gradual smooth boundary.

A2—5 to 10 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine granular structure; friable; common fine roots; common medium pores; organic coatings on sand grains; strongly acid; gradual smooth boundary.

B1—10 to 20 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; firm; common fine roots; many fine pores; thin clay films bridging sand grains; strongly acid; clear smooth boundary.

B21t—20 to 30 inches; yellowish brown (10YR 5/8) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; many fine pores; clay films on faces; of peds; few fine fragments of sandstone in lower part; very strongly acid; clear smooth boundary.

B22t—30 to 35 inches; yellowish brown (10YR 5/6) loam; common fine prominent strong brown (7.5YR 5/6) and brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; clay films on faces of peds; few fine roots; many fine pores; strongly acid; abrupt smooth boundary.

R—35 to 40 inches; red (2.5YR 5/8) hard sandstone; partly weathered in the upper few inches; extremely acid.

Thickness of the solum and depth to bedrock range from 20 to 40 inches.

The A1 or Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, chroma of 2 to 4. It is less than 6 inches thick in pedons where the value is 3. In some pedons, coarse fragments 2 to 76 millimeters in diameter make up to 15 percent, by volume, and fragments that are more than 76 millimeters in diameter map up to 2 percent, by volume. Reaction is generally very strongly acid to slightly acid, but it is neutral where lime has been added.

The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 6. It has the same texture, sandstone fragments, and reaction as those of the A1 or Ap horizon.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 8. The texture is loam, sandy

clay loam, or fine sandy loam. Sandstone fragments and reaction are similar to those of the A1 or Ap horizon. Some pedons do not have a B1 horizon.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 to 5, and chroma of 4 to 8. Some pedons have mottles in shades of brown, red, or yellow. The texture is sandy clay loam, clay loam, loam, or fine sandy loam. The clay content ranges from 18 to 35 percent. The B2t horizon has the same content and size of coarse fragments as the A1 or Ap horizon in the upper part, but the content of coarse fragments in the lower part ranges from 0 to 20 percent. Reaction is extremely acid to strongly acid.

Some pedons have a B3 horizon. It has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8, or hue of 5YR, value of 4 or 5, and chroma of 3 to 8. In some pedons, it is coarsely mottled in shades of red, brown, or gray. The texture is sandy clay loam, clay loam, loam, fine sandy loam, or loamy fine sand. In some pedons, fragments of sandstone 2 to 76 millimeters in diameter make up to 35 percent, by volume, and fragments 3 to 6 inches in diameter make up to 2 percent, by volume. Reaction is extremely acid to strongly acid.

The R layer is hard, brownish or reddish, acid sandstone. In most pedons, the sandstone is weathered in the upper few inches. The sandstone is interbedded with thin layers of shale and siltstone in some pedons.

Osage Series

The Osage series consists of deep, poorly drained, very slowly permeable soils formed in clayey alluvium. These soils are nearly level and are on flood plains of major streams and river systems. An apparent high water table is at a depth of less than 1 foot during winter and spring. Slopes are 0 to 1 percent. Soils of the Osage series are fine, montmorillonitic, thermic Vertic Haplaquolls.

Osage soils are associated with Lightning, Muldrow, and Verdigris soils. Lightning soils are lighter color. Muldrow soils are less acid, and Verdigris soils are coarser textured. All of these soils are on nearby flood plains.

Typical pedon of Osage silty clay loam, rarely flooded; 1,700 feet north and 400 feet west of the southeast corner of sec. 28, T. 15 N., R. 16 E.

A11—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine and medium granular structure; firm; common fine roots; slightly acid; abrupt smooth boundary.

A12—10 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine faint dark grayish brown and dark yellowish brown (10YR 4/4) mottles; moderate fine blocky structure; very firm; few fine roots; medium acid; clear smooth boundary.

B21g—16 to 36 inches; very dark grayish brown (10YR 3/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; common medium blocky structure; very firm; pressure faces on peds; slightly acid; clear smooth boundary.

B22g—36 to 50 inches; very dark grayish brown (10YR 3/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; common medium blocky structure; very firm; few nonintersecting slickenslides; few fine iron concretions; neutral; clear smooth boundary.

B3g—50 to 68 inches; very dark grayish brown (10YR 3/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4) mottles; moderate medium blocky structure; very firm; few fine iron concretions; neutral.

The solum ranges in thickness from 50 to 60 inches or more.

The A horizon has hue of 10YR, value of 2 or 3, and chroma or 1 or 2. The texture is silty clay loam in the upper part and silty clay loam or silty clay in the lower part. Reaction is strongly acid to mildly alkaline.

The B horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 2. It has mottles of higher chroma. The texture is clay or silty clay. Reaction ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part.

Parsons Series

The Parsons series consists of deep, somewhat poorly drained, very slowly permeable soils that formed in material weathered from clayey shale or clayey sediment (fig. 18). These soils are smooth, nearly level or very gently sloping, and are on uplands. A perched high water table is at a depth of 0.5 to 1.5 feet during winter and spring. Slopes range from 0 to 3 percent. Soils of the Parsons series are fine, mixed, thermic Mollic Albaqualfs.

Parsons soils are associated with the Carytown, Dennis, Kanima, Okemah, Taloka, and Woodson soils. Carytown soils are intermingled with the Parsons soils and have a natric horizon. Dennis, Okemah, and Woodson soils are on adjacent slopes and have a mollic epipedon. Kanima soils are intermingled and are loamy-skeletal.

Typical pedon of Parsons silt loam, 0 to 1 percent slopes; 2,640 feet south and 1,500 feet west of the northeast corner of sec. 10, T. 15 N., R. 15 E.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; friable; medium acid; clear smooth boundary.

A2—9 to 11 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium granular structure; friable; strongly acid; abrupt wavy boundary.

B21t—11 to 30 inches; very dark grayish brown (10YR 3/2) clay; many medium prominent red (2.5YR 4/8)

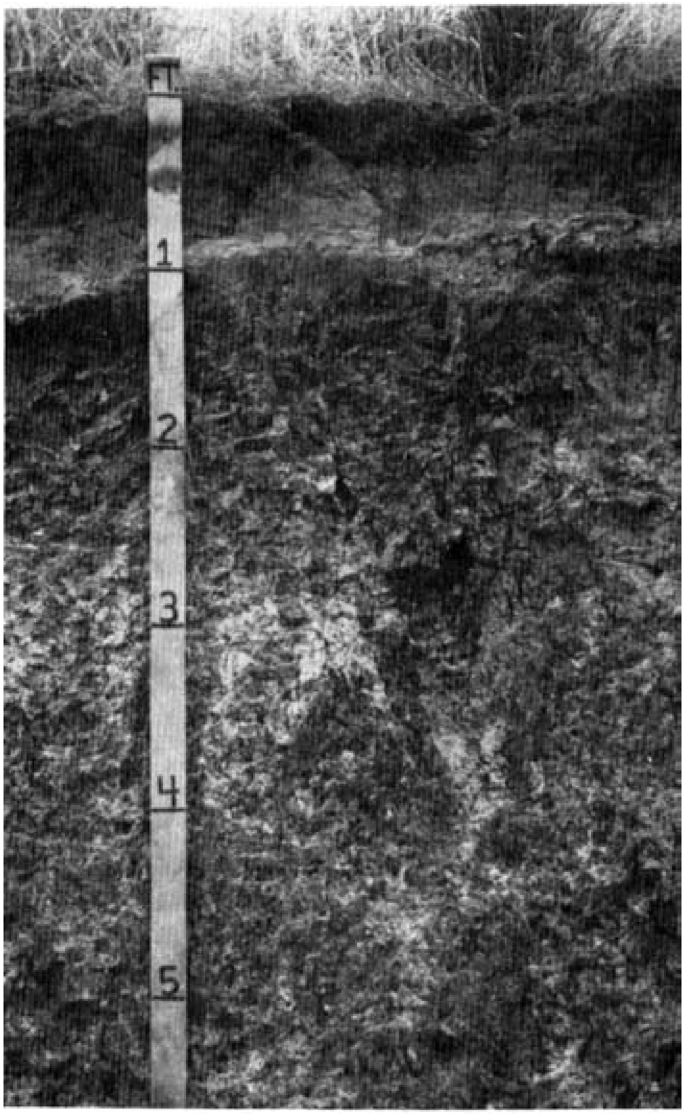


Figure 18.—Parsons silt loam, 0 to 1 percent slopes, has a clay subsoil that extends to a depth of at least 65 inches.

mottles and common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium blocky structure; very firm; thin continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—30 to 45 inches; grayish brown (2.5YR 5/2) clay; common coarse distinct strong brown (7.5YR 5/6) mottles and common medium distinct red (2.5YR 4/8) mottles; moderate coarse blocky structure; very firm; continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—45 to 65 inches; coarsely mottled gray (10YR 5/1) and strong brown (7.5YR 5/6) clay; weak coarse blocky structure; very firm; thin patchy clay films on faces of peds; slightly acid.

The solum is 40 to 60 inches or more thick. The A1 and A2 horizons combined are less than 16 inches thick.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction of these horizons ranges from strongly acid to slightly acid.

The B2t horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. Mottles in shades of brown, red, or gray range from few to many. The lower part of the B2t horizon can be coarsely mottled. Reaction ranges from strongly acid to slightly acid.

The B3 or C horizon has the same color and texture as those of the B2t horizon. Reaction ranges from strongly acid to moderately alkaline.

Roebuck Series

The Roebuck series consists of deep, somewhat poorly drained, very slowly permeable soils on flood plains of the Arkansas River and Dirty Creek. These soils are nearly level. They formed mostly in clayey alluvium. Slopes are 0 to 1 percent. Soils of the Roebuck series are fine, montmorillonitic, thermic Vertic Hapludolls.

Roebuck soils are associated with Barge, Keo, Latanier, Roxana, Severn, and Verdigris soils. Barge soils do not have a mollic epipedon and are on spoil banks of material dredged from river channels. Keo, Roxana, and Severn soils are on slightly higher stream terraces than Roebuck soils. These soils do not have a mollic epipedon and have less than 35 percent clay in the control section. Latanier soils are in slightly higher positions and have loamy material within a depth of 40 inches. Verdigris soils are closer to the stream channel and have less than 35 percent clay in the control section and hue of 10YR.

Typical pedon of Roebuck clay, occasionally flooded; about 675 feet west and 900 feet north of the southeast corner of sec. 21, T. 12 N., R. 20 E.

Ap—0 to 8 inches; dark brown (7.5YR 3/2) clay; weak fine granular structure; very firm; few fine roots; slightly acid; abrupt smooth boundary.

A1—8 to 22 inches; very dark grayish brown (10YR 3/2) clay; moderate very fine subangular blocky structure; very firm; few fine roots; slightly acid; gradual smooth boundary.

B21—22 to 39 inches; dark reddish brown (5YR 3/4) silty clay; weak medium prismatic structure parting to weak very fine subangular blocky; very firm; few fine roots; mildly alkaline; gradual smooth boundary.

B22—39 to 53 inches; dark reddish brown (5YR 3/4) silty clay; weak medium prismatic structure parting to weak very fine subangular blocky; very firm; few fine

calcium carbonate concretions in lower part; mildly alkaline; gradual smooth boundary.

C—53 to 70 inches; reddish brown (5YR 4/4) silty clay; massive; very firm; few fine calcium carbonate concretions; moderately alkaline.

The solum is more than 30 inches thick, and depth to secondary carbonates is more than 40 inches. Some pedons have a buried A horizon below a depth of 24 inches.

The A horizon has hue of 5YR, 7.5YR, or 10YR, value of 3, and chroma of 2 or 3. Reaction is slightly acid to mildly alkaline.

The B horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. Some pedons have mottles in shades of red and brown. The texture is silty clay loam to clay. Reaction is neutral to moderately alkaline.

The C horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. The texture is silty clay loam to clay. Thin, loamy layers are below a depth of 40 inches in some pedons.

Roxana Series

The Roxana series consists of deep, well drained, moderately permeable soils on flood plains of the Arkansas River. These soils are nearly level or very gently sloping. They formed in material weathered from loamy alluvial deposits. Slopes are smooth to slightly undulating and range from 0 to 3 percent. Soils of the Roxana series are coarse-silty, mixed, nonacid, thermic Typic Udifluvents.

Roxana soils are associated with Barge, Choska, Keo, Kiomatia, Latanier, Roebuck, and Severn soils. Barge and Severn soils are intermingled with the Roxana soils. Choska and Keo soils are on higher terraces, and Latanier, Kiomatia, and Roebuck soils are on lower terraces. Barge soils, in spoil areas along the Arkansas River, have a fine-silty control section. Choska, Keo, Latanier, and Roebuck soils have a mollic epipedon. Kiomatia soils have a sandy control section, and Severn soils are coarse-silty and are calcareous below a depth of 10 inches.

Typical pedon of Roxana very fine sandy loam, rarely flooded 0 to 1 percent slopes; 450 feet north and 20 feet west of the southeast corner of sec. 31, T. 12 N., R. 21 E.

Ap—0 to 7 inches; brown (7.5YR 4/4) very fine sandy loam; weak fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

C1—7 to 44 inches; reddish brown (5YR 4/3) very fine sandy loam; massive; very friable; few worm casts; few fine roots; many bedding planes of darker material, few fine strata of silt loam; mildly alkaline; clear smooth boundary.

C2—44 to 60 inches; reddish brown (5YR 4/4) very fine sandy loam; massive; very friable; few fine roots, few fine bedding planes; calcareous, mildly alkaline.

Bedding planes are evident in the 10- to 40-inch control section. The soil is more than 60 inches deep.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Reaction is slightly acid to mildly alkaline.

The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The texture is very fine sandy loam, loam, or silt loam in the upper part and loamy very fine sand in the lower part. Reaction is neutral to moderately alkaline. Some pedons have strata of coarser or finer material in the C horizon. Thin lenses and spots of calcareous material are below a depth of 10 inches in some pedons.

Severn Series

The Severn series consists of deep, well drained, moderately rapidly permeable soils on flood plains of the Arkansas and Canadian Rivers. These soils are nearly level to moderately sloping. They formed in loamy calcareous alluvium. Slopes are 0 to 6 percent. Soils of the Severn series are coarse-silty, mixed (calcareous), thermic Typic Udifluvents.

Severn soils are associated with Choska, Kiomatia, Latanier, Norwood, Roebuck, and Roxana soils. Choska soils are on terraces and have a mollic epipedon. Kiomatia soils are in lower positions than Severn soils and are sandy. Latanier and Roebuck soils are lower and have a mollic epipedon and over 35 percent clay in the control section. Norwood soils are near the stream and have 18 to 35 percent clay in the control section. Roxana soils are slightly higher or in intermingled areas and are noncalcareous in some part of the soil below a depth of 10 inches.

Typical pedon of Severn very fine sandy loam, rarely flooded, 0 to 1 percent slopes; about 800 feet east and 3,350 feet south of the northwest corner of sec. 29, T. 12 N., R. 21 E.

Ap—0 to 8 inches; reddish brown (5YR 4/3) very fine sandy loam; weak fine granular structure; very friable; few fine roots; calcareous, moderately alkaline; abrupt smooth boundary.

C—8 to 60 inches; reddish brown (5YR 5/4) very fine sandy loam; massive; very friable; few fine roots; thin bedding planes of dark reddish brown (5YR 3/3) fine sandy loam, dark reddish brown (5YR 3/4) silt loam, and dark brown (7.5YR 3/2) silty clay loam; calcareous, moderately alkaline.

These soils are at least 60 inches thick. Reaction is mildly alkaline or moderately alkaline in the surface layer and moderately alkaline below that. These soils are

typically calcareous in the upper 10 inches and are calcareous in all parts below that.

The Ap horizon has hue of 5YR, value of 3 or 4, and chroma of 3 or 4.

The C horizon has hue of 5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly very fine sandy loam, but thin bedding planes of silt loam, silty clay loam, loam, and fine sandy loam are common.

Shermore Series

The Shermore series consists of deep, moderately well drained, moderately slowly permeable soils that formed in loamy colluvial material and are underlain with interbedded sandstones and shales. These soils are gently sloping and are on broad, smooth, convex foot slopes. A perched high water table is at a depth of 1.5 to 3.5 feet in winter and spring. Slopes range from 3 to 5 percent. Soils of the Shermore series are fine-loamy, siliceous, thermic Typic Fragiudalfs.

Shermore soils are associated with Enders, Endsaw, and Linker soils. The associated soils do not have a fragipan. Enders and Endsaw soils are in higher positions than the Shermore soils and have a clayey particle-size control section. Linker soils are on similar slopes and have a solum 20 to 40 inches thick to sandstone.

Typical pedon of Shermore loam, 3 to 5 percent slopes; 2,000 feet west and 100 feet north of the southeast corner of sec. 11, T. 14. N., R. 19 E.

A1—0 to 7 inches; dark brown (10YR 4/3) loam; weak medium granular structure; friable; few fine black concretions; medium acid; clear smooth boundary.

A2—7 to 12 inches; brown (10YR 5/3) loam; weak medium granular structure; friable; few fine black concretions; medium acid; clear smooth boundary.

B1—12 to 20 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine fragments of sandstone; common fine black concretions; medium acid; gradual smooth boundary.

B2t—20 to 31 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles and few medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; patchy clay films on faces of peds; common fine black and strong brown concretions; few fine fragments of sandstone; strongly acid; clear wavy boundary.

Bx1—31 to 50 inches; coarsely mottled brown (10YR 5/3), yellowish brown (10YR 5/6), and dark gray (10YR 4/1) clay loam; moderate coarse prismatic structure parting to moderate fine subangular blocky; brittle; patchy clay films on faces of peds; common medium strong brown, black, and red concretions; gray streaks in seams between polygons; very strongly acid; gradual wavy boundary.

Bx2—50 to 65 inches; brownish yellow (10YR 6/6) sandy clay loam; few fine prominent red (2.5YR 4/6) mottles and few fine distinct strong brown (7/5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; brittle; thin patchy clay films on faces of peds; common fine black, red, and yellowish brown concretions; few small fragments of sandstone; strongly acid.

The solum is more than 60 inches thick. The fragipan is 20 to 40 inches below the surface. Yellowish brown and black concretions range from 1 to 10 percent, by volume, throughout the solum and are 2 to 10 millimeters in diameter. Red concretions range from 1 to 10 percent, by volume, in the B2t and Bx horizons.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 5. In some pedons, fragments of sandstone less than 76 millimeters in diameter make up to 10 percent of the volume. Reaction is strongly acid or medium acid.

The A2 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6. It is less than 6 inches thick. The texture is fine sandy loam or loam. In some pedons, fragments of sandstone less than 76 millimeters in diameter make up to 10 percent of the volume. Reaction is strongly acid or medium acid.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. In some pedons, it has mottles in shades of brown. The texture is loam, clay loam, or sandy clay loam. Reaction is strongly acid or medium acid. Some pedons do not have a B1 horizon.

The B2t horizon has hue or 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Mottles in shades of brown are in some pedons. The texture is loam, clay loam, or sandy clay loam. Fragments of sandstone less than 76 millimeters in diameter make up to 15 percent of the volume. Reaction is very strongly acid to medium acid.

The Bx horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8, and fine to coarse mottles in shades of red, brown, and gray; or it is mottled in shades of brown and gray. The texture is loam, sandy clay loam, or clay loam. The content of clay is 18 to 35 percent. Reaction is very strongly acid or strongly acid. The gray vertical streaks in seams between polygons range from 1 to 15 millimeters wide and are generally more clayey than the matrix.

Some pedons have a B3 horizon. It has the same colors and mottles as those at the Bx horizon. The texture is loam, sandy clay loam, or clay loam. Reaction ranges from medium acid to very strongly acid.

Shidler Series

The Shidler series consists of very shallow and shallow, well drained, moderately permeable soils that

formed in weathered residuum from limestone or chert of Mississippian or Pennsylvanian age. These soils are on moderately sloping to steep convex ridges and side slopes of uplands. Slopes are about 8 percent, but range from 5 to 30 percent. Soils of the Shidler series are loamy, mixed, thermic Lithic Haplustolls.

The Shidler soils in Muskogee County are taxadjuncts to the Shidler series because they are slightly more moist, or have a udic moisture regime, than is typical for the series, which has a Ustic moisture regime. This slight difference does not significantly change the use, management, or behavior of these soils. These soils also have brushy vegetation that is not typical of soils of the Shidler series.

Shidler soils are intermingled with Enders, Endsaw, Hector, Linker, and Oktaha soils. Enders and Endsaw soils have a clayey control section. Hector soils are shallow over sandstone, and Linker and Oktaha soils are moderately deep over sandstone.

Typical pedon of Shidler stony silty clay loam, in an area of Shidler-Rock outcrop complex, 5 to 30 percent slopes; about 3 miles south and 3 miles east of Fort Gibson, about 500 feet south and 400 feet west of the northeast corner of sec. 20, T. 15 N., R. 20 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) stony silty clay loam; moderate medium granular structure; friable; common fine pores; common fine roots; neutral; abrupt irregular boundary.

R—7 to 24 inches; hard, fractured, gray limestone; fractured at intervals of about 2 feet; soil material similar to that of the horizon above in fractures to a depth of 10 inches or more.

Thickness of the solum and depth to rock range from 4 to 20 inches. Reaction ranges from slightly acid to moderately alkaline throughout the solum.

The A1 horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 1 to 3. The texture is silt loam, silty clay loam, or clay loam or their stony counterparts. Clay content ranges from 18 to 35 percent. Fragments of limestone or chert range from 0 to 35 percent. By volume, coarse fragments 2 to 76 millimeters in diameter make up to 30 percent and fragments more than 76 millimeters in diameter make up to 20 percent.

The R layer is grayish or brownish limestone or chert. It has fractures 0.5 inch to 20.0 inches wide and 1.0 foot to 6.0 feet apart.

Spiro Series

The Spiro series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils are very gently sloping. They formed under a cover of mid and tall grasses and scattered hardwood trees in material weathered from siltstone and shale. A perched high water table is at a depth of 3 to 4 feet in the winter and spring. Slopes are 1 to 3 percent. Soils of the Spiro series are fine-silty, siliceous, thermic Ultic Hapludalfs.

Spiro soils are associated with Hector, Linker, and Oktaha soils. Hector soils are on ridges and are less than 20 inches to bedrock. Linker and Oktaha soils are in intermingled areas and are underlain by sandstone.

Typical pedon of Spiro silt loam, 1 to 3 percent slopes; 4,400 feet south and 400 feet east of the northwest corner of sec. 14, T. 14 N., R. 20 E.

A1—0 to 9 inches; dark brown (10YR 3/3) silt loam; weak fine granular structure; friable; common fine and medium roots and pores; few fine iron manganese concretions; strongly acid; gradual smooth boundary.

B1—9 to 12 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure and weak medium granular; friable; few fine roots and pores; few fine iron manganese concretions; strongly acid; gradual smooth boundary.

B21t—12 to 19 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; clay films on faces of peds; common fine iron manganese concretions; strongly acid; gradual wavy boundary.

B22t—19 to 32 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and very pale brown (10YR 7/3) mottles; weak medium subangular blocky structure; firm; clay films on faces of peds; common fine iron manganese concretions; strongly acid; diffuse wavy boundary.

B3—32 to 36 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and very pale brown (10YR 7/3) mottles; weak medium subangular blocky structure; firm; clay films on faces of peds; common fine iron manganese concretions and siltstone and sandstone fragments; strongly acid; abrupt smooth boundary.

Cr—36 to 40 inches; light yellowish brown (10YR 6/4) siltstone and shale; strongly acid.

Thickness of the solum and depth to bedrock range from 20 to 40 inches.

The A1 horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 2 or 3. Reaction is strongly acid to slightly acid.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The texture is loam or silt loam. Reaction is strongly acid or medium acid.

The B2t and B3 horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Most pedons have mottles in shades of brown and red. The texture is clay loam or silty clay loam. The B2t horizon is very strongly acid or strongly acid, and the B3 horizon is strongly acid or medium acid. The B3 horizon has common to many shale or siltstone fragments. In some pedons, it is mottled.

Stigler Series

The Stigler series consists of deep, moderately well drained, very slowly permeable soils that formed in clayey and loamy sediment. These soils are on smooth, nearly level uplands. A perched high water table is at a depth of 2 or 3 feet during winter and spring. Slopes range from 0 to 1 percent. Soils of the Stigler series are fine, mixed, thermic Aquic Paleudalfs.

Stigler soils are associated with Dennis and Taloka soils. Dennis soils are in higher areas than Stigler soils and have an A horizon less than 16 inches thick. Taloka soils are intermingled and have an abrupt textural change between the A2 horizon and B2t horizon.

Typical pedon of Stigler silt loam, 0 to 1 percent slopes; about 2,400 feet west and 2,640 feet north of the southeast corner of sec. 27, T. 12 N., R. 19 E.

A1—0 to 15 inches; grayish brown (10YR 5/2) silt loam; few fine faint brown mottles; weak fine granular structure; friable; very strongly acid; clear smooth boundary.

A2—15 to 26 inches; light brownish gray (10YR 6/2) silt loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; friable; very strongly acid; clear wavy boundary.

B21t—26 to 40 inches; brown (10YR 5/3) silty clay; many coarse distinct yellowish red (5YR 5/6) mottles and few medium faint grayish brown (10YR 5/2) mottles; moderate medium blocky structure; firm; continuous clay films on faces of peds; strongly acid; gradual wavy boundary.

B22t—40 to 64 inches; coarsely mottled strong brown (7.5YR 5/6), pale brown (10YR 6/3), and grayish brown (10YR 5/2) clay; weak coarse blocky structure; very firm; patchy clay films on faces of peds; few fine black concretions; strongly acid; diffuse wavy boundary.

B3—64 to 80 inches; gray (5YR 5/1) clay; many coarse distinct strong brown (7.5YR 5/6) mottles; weak coarse blocky structure; very firm; thin patchy clay films on faces of peds; few fine black concretions; very strongly acid.

The solum is more than 60 inches thick. The A horizon ranges in thickness from 16 to 30 inches. Base saturation of the A horizon is less than 50 percent.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. In unlimed areas, the reaction of the A1 and A2 horizons is very strongly acid or strongly acid.

The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 3 to 6; or it is mottled in shades of gray and brown or red. The texture is clay, silty clay, silty clay loam, or clay loam. Reaction ranges from very strongly acid to medium acid.

The B3 horizon has similar colors, textures, and reaction as those of the B2t horizon. Exchangeable sodium ranges from 4 to 16 percent

Taloka Series

The Taloka series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands (fig. 19). These soils are nearly level or very gently sloping. They formed in material weathered from clayey and loamy alluvium and colluvium. A perched high water table is at a depth of 1 foot to 2 feet during the winter and spring. Slopes are 0 to 3 percent. Soils of the Taloka series are fine, mixed, thermic Mollic Albaqualfs.

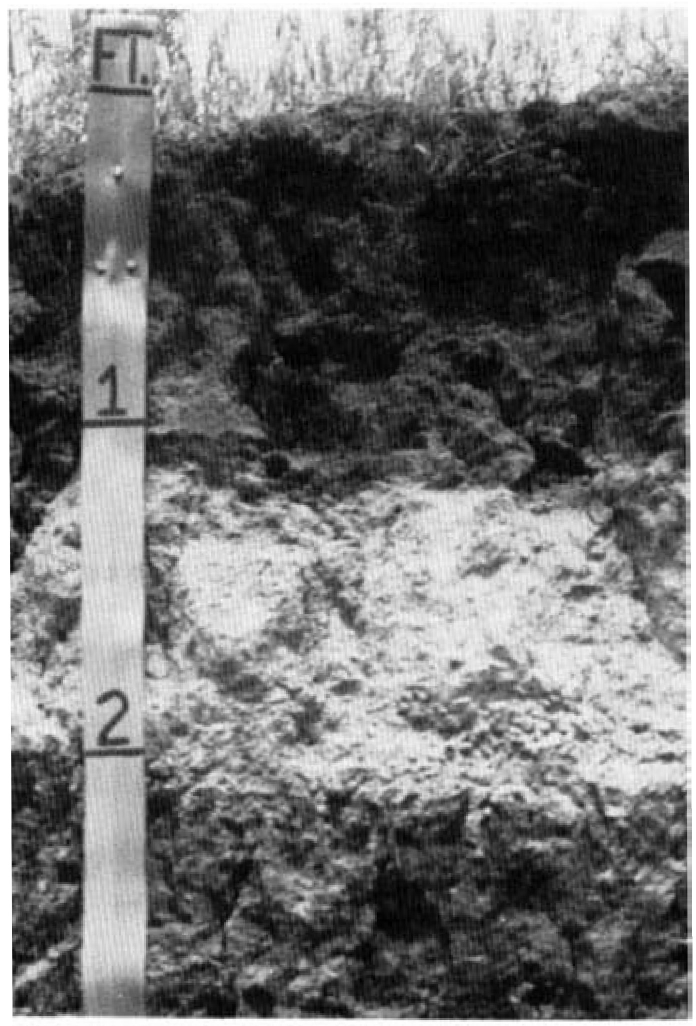


Figure 19.—Taloka silt loam, 1 to 3 percent slopes, has a thick, light colored A2 horizon at a depth of 12 to 25 inches.

Taloka soils are associated with Carytown, Choteau, Dennis, Kanima, Okemah, Parsons, Stigler, and Woodson soils. Carytown, Parsons, Stigler, and Woodson soils are intermingled with the Taloka soils. Carytown soils have a natric horizon, Parsons soils have an A horizon less than 16 inches thick, Stigler soils do not have an abrupt texture change between the A horizon and the B horizon, and Woodson soils have a mollic epipedon. Choteau, Dennis, Kanima, and Okemah soils are in higher positions than Taloka soils. Choteau, Dennis, and Okemah soils have a gradual texture change between the A horizon and the B2t horizon. Kanima soils are in mine waste areas, and they have fragments of an argillic horizon.

Typical pedon of Taloka silt loam, 0 to 1 percent slopes; 2,200 feet east and 400 feet south of the northwest corner of sec. 24, T. 16 N., R. 15 E.

A—0 to 16 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable; many fine roots; medium acid; clear smooth boundary.

A2—16 to 24 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; many fine roots; strongly acid; abrupt wavy boundary.

B21t—24 to 36 inches; dark grayish brown (10YR 4/2) clay; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; very firm; medium acid; gradual smooth boundary.

B22t—36 to 48 inches; grayish brown (10YR 5/2) clay; many coarse distinct yellowish brown (10YR 5/4) mottles; slightly acid; gradual smooth boundary.

B3—48 to 65 inches; coarsely mottled yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and gray (10YR 5/1) clay; weak fine subangular blocky structure; very firm; neutral.

The solum is 40 to 60 inches or more thick. The A horizon is 16 to 40 inches thick. The A horizon has less than 1 percent organic matter, or the base saturation of the B2t horizon is less than 50.

The A horizon has hue of 10YR, value of 3, and chroma of 2. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2. Reaction is slightly acid to strongly acid.

The B2 horizon has hue of 10YR, value of 3 to 5, and chroma or 2 to 4. It has mottles in shades of gray, brown, or red. The texture is clay or silty clay. Reaction is neutral to strongly acid.

The B3 horizon has colors and textures similar to those of the B2t horizon. It also includes silty clay loam and is coarsely mottled in shades of gray and brown. Reaction is slightly acid to moderately alkaline.

Tullahassee Series

The Tullahassee series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on flood plains. These soils are nearly level. They formed in sandy and loamy alluvium under a cover of trees with an understory of native grasses. An apparent high water table is at a depth of 0.5 foot to 3 feet in winter and spring. Slopes are dominantly less than 1 percent. Soils of the Tullahassee series are coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents.

Tullahassee soils are associated with Lightning and Verdigris soils. Lightning soils have an argillic horizon, and Verdigris soils have a mollic epipedon. These soils are mainly in higher positions than the Tullahassee soils.

Typical pedon of Tullahassee loamy fine sand, frequently flooded; 1,650 feet north and 1,000 feet west of the southeast corner of sec. 25, T. 10 N., R. 19 E.

A1—0 to 6 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; many fine roots; slightly acid; gradual smooth boundary.

C1—6 to 21 inches; dark brown (10YR 4/3) fine sandy loam; common medium distinct grayish brown (10YR 5/2) and reddish brown (5YR 4/4) mottles; friable; few fine strata of finer or coarser material; slightly acid; gradual smooth boundary.

C2—21 to 44 inches; dark yellowish brown (10YR 4/4) stratified fine sandy loam and loam; common medium distinct grayish brown (10YR 5/2) and dark brown (7.5YR 4/4) mottles; massive; friable; thin bedding planes of silt loam and very fine sandy loam; neutral; gradual smooth boundary.

C3—44 to 65 inches; grayish brown (10YR 5/2) stratified fine sandy loam and loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; thin strata of very fine sand and silty clay loam; slightly acid.

The soil is more than 60 inches deep. Reaction in all horizons ranges from neutral to medium acid.

The A1 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. Some pedons have mottles in shades of brown and gray. This horizon is less than 10 inches thick in pedons that have value of 3 and chroma of 2 or 3.

The C1 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It has mottles in shades of brown, gray, red, or yellow. The texture is loam and fine sandy loam that has thin strata of coarser or finer material.

The C2 and C3 horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. They have mottles in shades of brown, gray, yellow, or red. The texture is loam and fine sandy loam that has strata of finer or coarser material.

Verdigris Series

The Verdigris series consists of deep, moderately well drained, moderately permeable soils that formed in material weathered from silty alluvium. These soils are on smooth, nearly level flood plains of small tributary streams to major river systems. Soils of the Verdigris series are fine-silty, mixed, thermic Cumulic Hapludolls.

Verdigris soils are associated with Barge, Cupco, Lightning, Osage, Roebuck, and Tullahassee soils. Barge soils are in dreged, higher areas along the Arkansas River, and they have fragments of a mollic epipedon throughout the pedon. Cupco, Lightning, and Osage soils are further from the stream channel than Verdigris soils. Cupco soils are siliceous and have an aquic moisture control section, and Lightning and Osage soils have a fine particle-size control section. Roebuck and Tullahassee soils are mainly in lower positions further from the stream. Roebuck soils have a more clayey control section than Verdigris soils, and Tullahassee soils have a coarse-loamy control section.

Typical pedon of Verdigris silt loam, occasionally flooded; about 5 miles east of Fort Gibson, about 2,600 feet east and 1,500 feet south of the northwest corner of sec. 2, T. 15 N., R. 20 E.

Ap—0 to 9 inches; very dark brown (10YR 2/3) silt loam; weak fine granular structure; very friable; common fine and medium roots; neutral; clear smooth boundary.

A12—9 to 15 inches; dark brown (10YR 3/3) silt loam; fine medium subangular blocky structure; friable; common fine roots; few fine black bodies; neutral; gradual smooth boundary.

A13—15 to 31 inches; dark brown (10YR 3/3) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few fine black bodies; slightly acid; gradual wavy boundary.

C—31 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; few fine and medium iron concretions; medium acid.

The solum ranges in thickness from 24 to 50 inches. The reaction throughout ranges from medium acid to neutral.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3.

The A13 horizon has hue of 10YR, value of 2 to 5, and chroma of 1 to 4. Some pedons have faint mottles that have lower value and higher chroma below a depth of 24 inches. The texture is loam, silt loam, or silty clay loam.

The C horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The texture is loam, silt loam, silty clay loam, or clay loam.

Woodson Series

The Woodson series consists of deep, somewhat poorly drained, very slowly permeable soils that formed in material weathered from silt and clay sediment. These soils are nearly level. They are on uplands or stream terraces in prairie areas. A perched high water table is at a depth of 0.5 foot to 2 feet in winter and spring. Slopes range from 0 to 1 percent. Soils of the Woodson series are fine, montmorillonitic, thermic Abruptic Argiaquolls.

Woodson soils are on the same landscape with Dennis, Parsons, and Taloka soils. Dennis soils are on more sloping topography in higher areas, and they have a gradual change in texture from the A horizon to the B2t horizon. Parsons and Taloka soils have an A2 horizon and do not have a mollic epipedon.

Typical pedon of Woodson silty clay loam, 0 to 1 percent slopes; about 1 mile north and 1 mile west of Council Hill in a native pasture, about 2,400 feet east and 150 feet south of the northwest corner of sec. 26, T. 13 N., R. 15 E.

A1—0 to 12 inches; black (10YR 2/1) silty clay loam; strong fine and medium granular structure; firm; common medium and fine roots; slightly acid; abrupt smooth boundary.

B21t—12 to 16 inches; very dark gray (10YR 3/1) silty clay; moderate fine and medium subangular blocky structure; very firm; common fine roots; clay films on faces of peds; neutral; gradual smooth boundary.

B22t—16 to 24 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine and medium distinct yellowish brown (10YR 5/6) mottles; moderate fine blocky structure; very firm; few fine roots; clay films on faces of peds; few fine iron concretions; neutral; gradual smooth boundary.

B3—24 to 48 inches; dark grayish brown (2.5Y 4/2) clay; few fine and medium distinct yellowish brown (10YR 5/6) mottles; weak fine blocky structure; very firm; few fine roots; clay films on faces of peds; few fine gysum crystals; few fine iron concretions; mildly alkaline; gradual wavy boundary.

C—48 to 70 inches; light olive brown (2.5Y 5/3) clay; few fine and medium gray (10YR 6/1) mottles; massive; very firm; few fine iron concretions; mildly alkaline.

The solum ranges in thickness from 30 to 60 inches.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1. Reaction is medium acid or slightly acid.

The B21t horizon has hue of 10YR, value of 2 or 3, and chroma of 1.5 or less. The B22t horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or less. The texture is silty clay or clay. Reaction ranges from medium acid to neutral.

The B3 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. The texture is silty clay loam or clay. Reaction ranges from slightly acid to mildly alkaline.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. The texture is silty clay or clay. Reaction ranges from slightly acid to mildly alkaline.

Formation of the Soils

Factors of Soil Formation

Soil is the product of five major factors—parent material, climate, plants and animals, relief, and time. If a given factor, vegetation for example, differs from one area to another, the soils that form in the two areas will differ.

Parent Material

Parent material is one of the most influential factors of soil formation in the county. It establishes the limits of the physical properties and chemical and mineral composition of the soil, and it influences the rate of soil development. Parent material is the unconsolidated material from which soil is formed.

The parent material of the county is in two classes, residual or transported. Residual parent material is formed in place from the weathering of consolidated bedrock. Transported parent material is unconsolidated material that has been transported and redeposited by wind or water from the site of its parent bedrock. The soils that formed in residuum derived from bedrock of the Pennsylvanian System and from transported material of the Quaternary System.

Climate

The moist, subhumid, continental climate of Muskogee County is characterized by high-intensity rainfall. Moisture and warm temperatures have promoted the formation of distinct horizons in many of the soils. Differences in soils, however, cannot be attributed to climate because the climate is uniform throughout the county. Heavy rains have caused rapid runoff that has eroded many of the soils. This erosion is an indirect effect of climate.

Plants and Animals

Plants, burrowing animals, insects, and microorganisms have a direct influence on the formation of soil. In Muskogee County, plants have more influence on soil formation than animals. Native vegetation influences the amount of organic matter, the amount and kind of plant nutrients, and soil structure. Prairie vegetation adds more organic matter to the soil, causes a stronger grade of structure to develop in the surface layer, and recycles more nutrients to the upper horizons than does forest vegetation. For example, the Dennis and Taloka soils formed under prairie vegetation. They have a thicker, darker color surface layer that has a more developed granular structure and is richer in nutrients than the Glenpool and Enders soils, which formed under forest vegetation.

During the past century, man has altered this soil-forming factor by removing the native vegetation over much of the county. The lack of adequate conservation measures has resulted in much soil loss through sheet and gully erosion. Where some of the surface layer has been removed and gullies have formed, eroded phases of soils are mapped. An example is Larton loamy fine sand, 3 to 12 percent slopes, gullied.

Relief

Relief affects soil formation through its influence on moisture, drainage, erosion, temperature, and plant cover. The relief of Muskogee County is determined largely by the varying resistance of underlying bedrocks to weathering and geologic erosion.

The effects of relief on soil formation can be illustrated by contrasting the Dennis and Hector soils. Dennis soils are in areas of less sloping relief than the Hector soils and have a thicker solum that has more developed horizons. The difference is primarily the result of the Dennis soils having less surface runoff and more water percolating into the soil. This affects the loss, gain, or transfer of soil constituents.

Time

Time as a factor cannot be measured strictly in years. The length of time needed for the development of genetic horizons depends on the intensity and interactions of the soil-forming factors in promoting the loss, gain, transfer, or transformation of soil constituents that are necessary to form soil horizons. Soils that do not have definite horizons are young or immature. Mature soils have approached equilibrium with their environment and tend to have well defined horizons.

The soils of Muskogee County range from young to old. Some of the mature soils are the Dennis and Taloka soils on uplands. Kamie and Larton soils are younger but also have clearly defined horizons. Hector soils are considered to be young. They have had sufficient time to develop clearly defined horizons, but because they are sloping, geologic erosion removes soil material almost as

fast as it forms. Norwood and Severn soils on flood plains have been developing for such a short time that they show little development of horizons.

Processes of Horizon Differentiation

Active processes that have influenced the formation of horizons in the soils of Muskogee County are accumulation of organic matter, leaching of calcium carbonate and bases, and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

Prairie vegetation adds more organic matter to the surface layer and contributes to a more developed granular structure than does forest vegetation. Dennis soils formed under prairie vegetation. The surface layer is high in content of organic matter and is called a mollic epipedon in the soil classification system. Kamie soils formed under forest vegetation and contain less organic matter than Dennis soils. Their surface layer is called an ochric epipedon.

Leaching of carbonates and bases is active in the formation of soils. The accumulation of bases in the lower part of the B horizon of Parsons soils indicates the depth to which water has percolated. Enders soils have leached to the extent that they do not have an accumulation of calcium carbonate. Also, more bases have been leached from the B horizon of Enders soils; this is reflected by their base saturation. Soils on flood plains, such as Verdigris soils, are recharged with bases when flooding occurs. The more acid Tullahassee soils have not been leached, but they receive sediment from neutral to acid soils. Eram soils formed over shales and are high in bases. Bases in Eram soils are related to the nature of the native vegetation.

The translocation of silicate clay minerals is very important in establishing the properties and classification of soils. Clay films on faces of peds, clay bridging of sand grains, and an increase in total clay are evidence of argillic horizons. The varying degrees of translocation of silicate clay minerals and the kind of parent material in which a soil formed have resulted in wide variations in the texture and other properties of the argillic horizon in different soils. Parsons and Taloka soils have a subsurface layer (A2 horizon) that is more intensely leached of silicate clay minerals than the surface layer (A1 or Ap horizon) of other soils in the county.

Prairie vegetation brings bases to the surface. This retards leaching and the formation of a subsurface layer. Geologic erosion on such soils as Coweta soils hinders horizon development. In Tullahassee, Kiomatia, and other soils on flood plains, the sediment was deposited so recently that not enough time has lapsed for horizons to form.

Geology

Kenneth S. Johnson, Oklahoma Geological Survey, The University of Oklahoma, prepared this section.

The geology of Muskogee County is fairly simple. A generalized geology map of the county accompanies the general soil map at the back of this publication *(3, 4)*. Outcropping rocks consist mainly of Pennsylvanian sandstones, shales, and coals deposited on lowlands and in shallow seas that once covered much of eastern Oklahoma. In many parts of the county these sedimentary rocks are mantled by unconsolidated alluvium laid down by ancient or modern rivers and streams. These outcropping strata overlie additional sedimentary rocks that are important reservoirs for petroleum in many parts of the county.

Subsurface rock units of sedimentary origin in Muskogee County are about 2,500 feet thick in the northeast, about 4,500 feet thick in the southwest, and as much as 8,000 feet thick in the south. These strata rest upon a "basement" of granite and other igneous or metamorphic rocks that extend some 20 to 25 miles down into the earth's crust. The subsurface sedimentary rocks were deposited in great, shallow seas of the Arkoma Basin of eastern Oklahoma and western Arkansas. These shallow seas inundated the Muskogee County area intermittantly from the Cambrian period, about 525 million years ago, until the middle part of the Pennsylvanian period, about 300 million years ago. Muskogee County is on the northern shelf of the Arkoma Basin. The various rock formations that underlie the county dip gently to the west and south.

Most of the outcropping rocks of Muskogee County were laid down during the early and middle parts of the Pennsylvanian period. Sands, silts, and clays were eroded from lowland areas of the broad Ozark Uplift to the northeast and the central Oklahoma arch to the west and northwest. The material was transported by streams and rivers that then flowed from the two major uplifted areas toward the large Arkoma Basin. Muskogee County was the site for deposition of interbedded sandstones, siltstones, and shales laid down as the environment shifted back and forth between river, delta, tidal flat, and shallow sea. Extensive swamps were formed intermittantly on the coastal lowlands of eastern Oklahoma, and subsequent burial, compaction, and alteration of the swamp's plant material created coal deposits.

The oldest exposed rocks in Muskogee County crop out in the east and are overlain by successively younger Pennsylvanian strata to the west. Outcropping strata dip generally to the west across the county. In some areas, this dip is locally reversed by faults and broad folds.

Because the soils in most areas result from the weathering and disaggregation of outcropping rock units, there is a close relationship between the character of these rock formations and the soils that develop upon

them. A description of the outcropping rock units in the county can help explain the character and distribution of the soils.

The oldest rock units exposed in Muskogee County are a series of interbedded shales and limestones mainly along creeks and rivers in the northeastern part of the county. They include (from oldest to youngest) the Fernvale Limestone and Sylvan Shale of Ordovician age; the Chattanooga Shale of Devonian-Mississippian age; the Moorefield, Hindsville, Fayetteville, and Pitkin Formations of Mississippian age; and the Hale and Bloyd Formations of earliest Pennsylvanian age. Each of these formations typically is 20 to 100 feet thick, and the shales and limestones are mostly gray to black. Soils developed upon these strata are all in the Enders-Hector-Linker general soil map unit. Typically, soils are well drained and have a loamy surface layer and a clayey or loamy subsoil. They range from deep to shallow and from very gently sloping to very steep. The topography is rough where these rock units are at the surface.

Overlying the Bloyd and Hale Formations is a thick sequence of interbedded shales and sandstones that crop out throughout most of the eastern half of the county. These formations include (from oldest to youngest) the Atoka, Hartshorne, and McAlester Formations. The Atoka Formation is gray or brown sandstone about 50 feet thick. The Hartshorne Formation is a series of gray to brown shales and sandstones that are about 1,000 feet thick in the southeast and about 400 feet thick in the northeast. The McAlester Formation is gray silty shales separated by several thick sandstone beds and several coal seams. This formation is about 200 to 400 feet thick. The areas where these rock units are at the surface are characterized by broad plains over the shale outcrops and wooded hills and ridges over the sandstone outcrops. Soils overlying these formations are in the Dennis-Bates-Coweta, Taloka-Parsons-Stigler, Enders-Hector-Linker, and Oktaha-Hector general soil map units. The soils in these map units have a loamy or clayey subsoil, are nearly level to steep, and are somewhat poorly drained to somewhat excessively drained. These characteristics result largely from the nature of the underlying bedrock.

Overlying these strata is a thick series of shale formations that contain several relatively thin sandstone, limestone, and coal interbeds. These formations are mainly in the western half of the county. They include (from oldest to youngest) the Savanna, Boggy, Stuart Shale, and Senora Formations. The Savanna Formation is dark gray shale that has a few thin beds of sandstone, limestone, and coal. This formation is about 200 to 400 feet thick. The Boggy Formation is 450 to 700 feet thick. It is sandy shale interbedded with several sandstone units 10 to 50 feet thick and several thin layers of limestone and coal. The Stuart Shale and Senora Formations are about 500 feet thick in the northwest and about 1,300 feet thick in the southwest. They consist mainly of gray shale that has thick interbeds of sandstone and thin interbeds of limestone and coal. Outcrops of these formations are mantled mainly by soils of the Dennis-Bates-Coweta and Taloka-Parsons-Stigler general soil map units, although locally in the southeast part of the county, they are mantled by the Enders-Hector-Linker and Oktaha-Hector general soil map units.

Quaternary age alluvium and terrace deposits in Muskogee County generally are 10 to 100 feet thick and consist mainly of unconsolidated sand, silt, clay, and minor amounts of gravel. These sediments were eroded from Pennsylvanian strata within and to the west of the county and from any other rock units that are west and northwest of the county and are within the Arkansas and Canadian River drainage basins. Quaternary sediment was laid down mainly as flood plain or alluvial deposits along major rivers and streams flowing predominantly to the east, southeast, and northeast across the county.

Terrace deposits consist of older alluvium left behind after a river shifts position or cuts more deeply into underlying material. These deposits occur either as broad and level, or hummocky and undulating expanses that are topographically higher than, and generally adjacent to, the present-day flood plains. They occur mainly northwest of the Canadian River flood plain, but also in large and small areas along the Arkansas River. These terrace deposits are mantled by soils of the Kamie-Larton general soil map unit. Typically, these soils are deep, nearly level to strongly sloping, moderately permeable, and well drained. They are loamy or sandy.

Alluvial deposits are the unconsolidated sediment in stream channels or flood plains of modern-day rivers and streams, such as the main stream and tributaries of the Arkansas and Canadian Rivers. The Arkansas and Canadian River alluvium is mantled by soils of the Severn-Kiomatia-Roebuck general soil map unit. Typically these soils are deep, nearly level to moderately sloping, and well drained or somewhat poorly drained. Alluvium along the main tributaries to the Arkansas River are covered by soils of the Verdigris-Lightning general soil map unit. These soils are deep, nearly level, and moderately well drained and somewhat poorly drained.

The mineral and water resources of Muskogee County are important to the overall development and progress of the county. Oil, natural gas, and coal have been produced in considerable quantities. Petroleum production in the county in 1983 amounted to about 459,000 barrels of crude oil (valued at nearly 13.6 million dollars) and about 1.57 billion cubic feet of natural gas (valued at 2.5 million dollars). Coal production during 1983 amounted to about 220,000 short tons (valued at about 7.0 million dollars). The principal coal seams mined now and in the past are the Stigler coal in the McAlester Formation and the Secor coal in the Boggy Formation. Other important mineral resources that have

been produced at various times in the county are sand, gravel, limestone, sandstone (flagstone), and clays or shales. Abundant quantities of good-quality ground water are in some of the major alluvial and terrace deposits along the Arkansas and Canadian Rivers. These aquifers are recharged by precipitation and runoff that percolates down through the soil into the porous and permeable material, and also by discharge from the rivers and streams flowing over the alluvial deposits. Lesser quantities of fair-quality ground water are in some of the many sandstone layers making up the Pennsylvanian strata in the county.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. Soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as—

	Inches of water per inch of soil
Very low	less than 0.05
Low	0.05 to 0.10
Moderate	0.10 to 0.15
High	0.15 to 0.20
Very high	more than 0.20

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but that have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels, i.e., clay coatings, clay skins.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants

throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium is in the soil. The resulting poor physical properties restrict the growth of plants.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

Fragile (in tables). The soil is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as

protection against erosion. Conducts surface water away from cropland.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments that are 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

	Percent
Very low	less than 0.5
Low	0.5 to 1.0
Moderate	1.0 to 2.0
Moderately high	2.0 to 4.0
High	4.0 to 8.0
Very high	8.0 to 16.0

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (soil science). Unconsolidated, residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). The soil mass is susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). An excessive amount of toxic substances in the soil, such as sodium or sulfur, severely hinders the establishment of vegetation or severely restricts plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of course grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. This contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data recorded in the period 1951-77 at Muskogee, Oklahoma]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	49.0	27.7	38.4	75	2	17	1.65	.75	2.37	4	2.4
February---	55.0	32.4	43.8	79	9	41	2.16	.93	3.15	4	3.0
March------	62.8	39.6	51.2	87	16	171	3.22	1.39	4.70	6	.8
April------	73.7	50.3	62.1	90	28	367	4.72	2.82	6.41	7	.0
May--------	80.6	58.6	69.6	92	39	608	4.96	2.60	6.88	7	.0
June-------	88.1	66.8	77.5	98	50	825	4.37	2.14	6.18	6	.0
July-------	93.8	70.9	82.4	106	56	1,004	3.29	.83	5.23	5	.0
August-----	93.1	69.4	81.3	104	57	970	3.14	1.29	4.62	5	.0
September--	85.3	62.4	73.9	100	43	717	4.36	1.67	6.53	6	.0
October----	74.8	50.9	62.9	92	31	407	3.52	.67	5.71	4	.0
November---	61.0	39.4	50.2	81	16	108	2.94	.99	4.50	4	.5
December---	51.7	31.3	41.5	75	5	20	2.32	1.09	3.31	4	.9
Yearly:											
Average--	72.4	50.0	61.2	---	---	---	---	---	---	---	---
Extreme--	---	---	---	106	0	---	---	---	---	---	---
Total----	---	---	---	---	---	5,255	40.65	31.51	49.22	62	7.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data recorded in the period 1951-77 at Muskogee, Oklahoma]

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 1	April 5	April 11
2 years in 10 later than--	March 24	March 31	April 7
5 years in 10 later than--	March 9	March 20	March 31
First freezing temperature in fall:			
1 year in 10 earlier than--	October 30	October 29	October 19
2 years in 10 earlier than--	November 6	November 4	October 23
5 years in 10 earlier than--	November 20	November 14	November 2

TABLE 3.--GROWING SEASON

[Data recorded in the period 1951-77 at Muskogee, Oklahoma]

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	220	214	198
8 years in 10	232	223	204
5 years in 10	256	239	215
2 years in 10	279	255	225
1 year in 10	292	264	231

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Barge silt loam, 3 to 30 percent slopes	290	0.1
2	Bates loam, 1 to 3 percent slopes	21,015	3.9
3	Bates loam, 3 to 5 percent slopes	15,830	2.9
4	Bates loam, 2 to 5 percent slopes, eroded	2,825	0.5
5	Bates-Coweta fine sandy loams, 1 to 3 percent slopes	6,300	1.2
6	Bates-Coweta fine sandy loams, 3 to 5 percent slopes	11,160	2.1
7	Caspiana silt loam, rarely flooded	590	0.1
8	Choska silt loam, rarely flooded	1,535	0.3
9	Choteau loam, 1 to 3 percent slopes	3,935	0.7
10	Coweta fine sandy loam, 5 to 12 percent slopes	11,010	2.0
11	Cupco silt loam, occasionally flooded	6,610	1.2
12	Dennis silt loam, 1 to 3 percent slopes	56,790	10.6
13	Dennis silt loam, 3 to 5 percent slopes	11,625	2.2
14	Dennis silt loam, 2 to 5 percent slopes, eroded	11,660	2.2
15	Dennis silt loam, 2 to 6 percent slopes, gullied	6,700	1.2
16	Dennis-Urban land complex, 0 to 3 percent slopes	1,715	0.3
17	Dennis-Verdigris complex, 0 to 12 percent slopes	31,205	5.8
18	Enders-Linker-Hector association, moderately steep	41,830	7.8
19	Endsaw-Hector association, steep	7,320	1.4
20	Eram-Coweta-Rock outcrop association, strongly sloping	10,525	2.0
21	Garton silt loam, rarely flooded	895	0.2
22	Glenpool fine sand, 0 to 3 percent slopes	455	0.1
23	Glenpool fine sand, 3 to 12 percent slopes	2,665	0.5
24	Kamie fine sandy loam, 1 to 3 percent slopes	3,140	0.6
25	Kamie fine sandy loam, 3 to 5 percent slopes	5,605	1.0
26	Kamie fine sandy loam, 2 to 8 percent slopes, gullied	2,420	0.4
27	Kanima shaly silty clay loam, 3 to 30 percent slopes	1,445	0.3
28	Keo very fine sandy loam, rarely flooded	1,000	0.2
29	Kiomatia loamy fine sand, frequently flooded	1,455	0.3
30	Kiomatia fine sandy loam, rarely flooded	3,720	0.7
31	Kiomatia fine sandy loam, frequently flooded	1,685	0.3
32	Larton loamy fine sand, 0 to 3 percent slopes	2,470	0.5
33	Larton loamy fine sand, 3 to 8 percent slopes	3,435	0.6
34	Larton loamy fine sand, 3 to 12 percent slopes, gullied	2,215	0.4
35	Latanier silty clay loam, rarely flooded	1,585	0.3
36	Lightning silt loam, occasionally flooded	3,700	0.7
37	Linker fine sandy loam, 1 to 3 percent slopes	1,475	0.3
38	Linker fine sandy loam, 3 to 5 percent slopes	1,495	0.3
39	Mason silt loam, rarely flooded, 0 to 1 percent slopes	4,840	0.9
40	Mason silt loam, rarely flooded, 1 to 3 percent slopes	500	0.1
41	Muldrow silty clay loam, rarely flooded	1,170	0.2
42	Norwood silt loam, rarely flooded	1,500	0.3
43	Oil-waste land	525	0.1
44	Okay very fine sandy loam, 0 to 1 percent slopes	685	0.1
45	Okay very fine sandy loam, 1 to 3 percent slopes	2,880	0.5
46	Okemah silt loam, 0 to 1 percent slopes	1,450	0.3
47	Oktaha fine sandy loam, 1 to 3 percent slopes	6,050	1.1
48	Oktaha fine sandy loam, 3 to 5 percent slopes	6,020	1.1
49	Oktaha fine sandy loam, 2 to 5 percent slopes, eroded	1,585	0.3
50	Oktaha-Hector fine sandy loams, 1 to 5 percent slopes	15,960	3.0
51	Osage silty clay loam, rarely flooded	1,605	0.3
52	Parsons silt loam, 0 to 1 percent slopes	17,470	3.2
53	Parsons silt loam, 1 to 3 percent slopes	11,865	2.2
54	Parsons silt loam, 1 to 3 percent slopes, eroded	3,525	0.7
55	Parsons-Carytown silt loams, 0 to 1 percent slopes	1,960	0.4
56	Pits	755	0.1
57	Roebuck clay, rarely flooded	2,330	0.4
58	Roebuck clay, occasionally flooded	2,215	0.4
59	Roebuck clay, frequently flooded	1,670	0.3
60	Roxana very fine sandy loam, rarely flooded, 0 to 1 percent slopes	3,455	0.6
61	Roxana very fine sandy loam, rarely flooded, 1 to 3 percent slopes	1,665	0.3
62	Severn very fine sandy loam, rarely flooded, 0 to 1 percent slopes	7,885	1.5
63	Severn very fine sandy loam, rarely flooded, 2 to 6 percent slopes	595	0.1
64	Shermore loam, 3 to 5 percent slopes	560	0.1
65	Shidler-Rock outcrop complex, 5 to 30 percent slopes	1,785	0.3

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
66	Spiro silt loam, 1 to 3 percent slopes	995	0.2
67	Stigler silt loam, 0 to 1 percent slopes	8,980	1.7
68	Stigler silt loam, 1 to 3 percent slopes	22,325	4.1
69	Stigler-Urban land complex, 0 to 3 percent slopes	3,750	0.7
70	Taloka silt loam, 0 to 1 percent slopes	19,380	3.6
71	Taloka silt loam, 1 to 3 percent slopes	27,430	5.1
72	Taloka-Urban land complex, 0 to 3 percent slopes	860	0.2
73	Tullahassee loamy fine sand, frequently flooded	930	0.2
74	Urban land	1,335	0.2
75	Verdigris silt loam, rarely flooded	890	0.2
76	Verdigris silt loam, occasionally flooded	11,470	2.1
77	Verdigris silt loam, frequently flooded	15,875	2.9
78	Woodson silty clay loam, 0 to 1 percent slopes	1,325	0.2
	Water	18,860	3.5
	Total	538,240	100.0

TABLE 5.--GRAZING YIELDS PER ACRE OF PASTURE AND FORAGE CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates the crop or grass is seldom grown or is not suited to the soil]

Map symbol and soil name	Improved bermudagrass	Tall fescue	Weeping lovegrass	Forage sorghum	Small grains	Plains and Caucasian bluestem
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
1 Barge	4.0	---	4.5	---	---	3.5
2 Bates	6.5	5.5	7.0	4.5	4.0	7.0
3 Bates	6.0	5.0	7.0	4.5	3.5	6.5
4 Bates	5.5	4.5	5.5	3.5	3.0	5.5
5 Bates-Coweta	5.5	4.5	6.0	4.0	3.5	5.5
6 Bates-Coweta	5.0	4.0	5.0	4.0	3.0	5.0
7 Caspiana	9.0	8.0	---	6.0	5.0	9.5
8 Choska	9.0	8.0	---	6.0	5.0	9.5
9 Choteau	7.0	6.0	7.0	5.0	4.5	7.5
10 Coweta	4.0	---	---	---	---	3.5
11 Cupco	7.0	6.0	---	---	---	5.0
12 Dennis	7.0	6.0	7.0	5.0	4.5	7.0
13 Dennis	6.5	5.5	7.0	5.0	4.0	6.5
14 Dennis	5.5	4.5	6.0	4.5	3.5	5.5
15 Dennis	4.0	---	3.5	---	---	4.5
16 Dennis-Urban land	---	---	---	---	---	---
17 Dennis-Verdigris	7.0	6.0	---	---	---	6.0
18 Enders-Linker-Hector	---	---	---	---	---	---
19 Endsaw-Hector	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--GRAZING YIELDS PER ACRE OF PASTURE AND FORAGE CROPS--Continued

Map symbol and soil name	Improved bermudagrass	Tall fescue	Weeping lovegrass	Forage sorghum	Small grains	Plains and Caucasian bluestem
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
20: Eram-Coweta-Rock outcrop	---	---	---	---	---	---
21: Garton	9.0	8.0	---	6.0	5.0	8.0
22: Glenpool	5.5	---	6.0	3.0	2.5	5.0
23: Glenpool	4.5	---	5.5	2.0	2.5	4.0
24: Kamie	6.5	---	6.5	4.5	4.0	7.0
25: Kamie	6.0	---	6.5	4.0	4.0	6.0
26: Kamie	4.0	---	4.5	---	---	5.0
27: Kanima	---	---	---	---	---	---
28: Keo	9.0	8.0	---	6.0	5.0	9.5
29: Kiomatia	5.0	---	---	---	---	---
30: Kiomatia	6.0	---	---	3.5	3.0	6.0
31: Kiomatia	5.0	---	---	---	---	---
32: Larton	6.0	---	7.0	4.0	4.0	6.5
33: Larton	5.0	---	6.0	4.0	4.0	4.5
34: Larton	4.0	---	4.0	---	---	---
35: Latanier	8.0	8.0	---	4.5	4.5	6.5
36: Lightning	8.0	8.0	---	4.5	4.5	5.5
37: Linker	6.5	5.5	6.5	4.0	3.5	6.5
38: Linker	6.0	5.0	6.0	4.0	3.5	5.5
39: Mason	9.0	8.0	---	6.0	5.0	10.0

See footnote at end of table.

TABLE 5.--GRAZING YIELDS PER ACRE OF PASTURE AND FORAGE CROPS--Continued

Map symbol and soil name	Improved bermudagrass	Tall fescue	Weeping lovegrass	Forage sorghum	Small grains	Plains and Caucasian bluestem
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
40 Mason	9.0	8.0	---	6.0	5.0	9.5
41 Muldrow	8.0	8.0	---	4.5	4.5	6.0
42 Norwood	8.0	---	---	4.5	4.5	9.5
43 Oil-waste land	---	---	---	---	---	---
44 Okay	8.0	7.0	---	6.0	5.0	8.5
45 Okay	7.0	6.5	---	6.0	5.0	7.5
46 Okemah	8.0	7.5	---	6.0	5.0	7.0
47 Oktaha	6.5	5.5	7.0	4.5	4.0	6.5
48 Oktaha	6.0	5.0	7.0	4.5	3.5	5.5
49 Oktaha	5.5	4.5	5.5	3.5	3.0	4.5
50 Oktaha-Hector	5.0	---	---	---	3.0	4.5
51 Osage	6.5	7.5	---	4.0	---	5.5
52 Parsons	6.0	5.0	---	4.0	4.0	5.5
53 Parsons	5.5	4.5	---	4.0	4.0	5.0
54 Parsons	5.0	4.0	---	3.5	3.5	4.5
55 Parsons-Carytown	4.5	---	---	---	3.0	---
56 Pits	---	---	---	---	---	---
57 Roebuck	6.5	7.5	---	5.0	---	6.0
58 Roebuck	6.0	7.0	---	4.0	---	5.0
59 Roebuck	5.5	6.5	---	---	---	---

See footnote at end of table.

TABLE 5.--GRAZING YIELDS PER ACRE OF PASTURE AND FORAGE CROPS--Continued

Map symbol and soil name	Improved bermudagrass	Tall fescue	Weeping lovegrass	Forage sorghum	Small grains	Plains and Caucasian bluestem
	AUM*	AUM*	AUM*	AUM*	AUM*	AUM*
60------------------------ Roxana	9.0	8.5	---	6.0	5.0	9.5
61------------------------ Roxana	8.0	7.5	---	5.0	4.0	8.5
62------------------------ Severn	9.0	8.5	---	6.0	5.0	9.5
63------------------------ Severn	8.0	7.5	---	5.0	4.0	8.0
64------------------------ Sheremore	5.0	4.0	---	3.5	2.5	5.5
65------------------------ Shidler	---	---	---	---	---	---
66------------------------ Spiro	7.0	6.0	---	---	---	7.0
67------------------------ Stigler	7.0	5.0	---	4.5	4.5	6.0
68------------------------ Stigler	6.5	4.5	---	4.5	4.5	5.0
69------------------------ Stigler-Urban land	---	---	---	---	---	---
70------------------------ Taloka	7.0	6.0	---	5.0	4.5	6.5
71------------------------ Taloka	6.5	5.5	---	5.0	4.5	6.0
72------------------------ Taloka-Urban land	---	---	---	---	---	---
73------------------------ Tullahassee	7.0	8.0	---	5.0	---	---
74------------------------ Urban land	---	---	---	---	---	---
75------------------------ Verdigris	9.0	8.0	---	6.0	5.0	9.5
76------------------------ Verdigris	9.0	8.0	---	4.5	4.5	7.5
77------------------------ Verdigris	9.0	8.0	---	---	---	---
78------------------------ Woodson	6.0	5.0	---	4.5	4.0	5.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, five sheep, or five goats) for 30 days.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Land capability	Wheat	Soybeans	Grain sorghum	Alfalfa hay
		Bu	Bu	Bu	Tons
1------------------------ Barge	VIe	---	---	---	---
2------------------------ Bates	IIe	35	25	55	3.0
3------------------------ Bates	IIIe	30	20	50	---
4------------------------ Bates	IIIe	20	---	40	---
5------------------------ Bates-Coweta	IIIe	30	---	40	---
6------------------------ Bates-Coweta	IVe	25	---	---	---
7------------------------ Caspiana	I	45	40	70	5.0
8------------------------ Choska	I	45	40	70	4.5
9------------------------ Choteau	IIe	35	30	60	4.0
10----------------------- Coweta	VIe	---	---	---	---
11----------------------- Cupco	IIIw	30	25	45	3.0
12----------------------- Dennis	IIe	35	30	60	3.5
13----------------------- Dennis	IIIe	30	25	55	---
14----------------------- Dennis	IIIe	25	---	45	---
15----------------------- Dennis	VIe	---	---	---	---
16. Dennis-Urban land					
17----------------------- Dennis-Verdigris	VIe	---	---	---	---
18----------------------- Enders-Linker-Hector	VIIe	---	---	---	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Wheat	Soybeans	Grain sorghum	Alfalfa hay
		Bu	Bu	Bu	Tons
19-----------------------Endsaw-Hector	VIIs	---	---	---	---
20:					
Eram---------------------	VIe	---	---	---	---
Coweta-------------------	VIe	---	---	---	---
Rock outcrop-------------	VIIIs	---	---	---	---
21-----------------------Garton	I	40	30	65	4.5
22-----------------------Glenpool	IVs	15	---	25	---
23-----------------------Glenpool	VIe	---	---	---	---
24-----------------------Kamie	IIe	30	20	45	---
25-----------------------Kamie	IIIe	25	20	40	---
26-----------------------Kamie	VIe	---	---	---	---
27-----------------------Kanima	VIIs	---	---	---	---
28-----------------------Keo	I	40	40	---	5.0
29-----------------------Kiomatia	Vw	---	---	---	---
30-----------------------Kiomatia	IIIs	25	25	40	3.0
31-----------------------Kiomatia	Vw	---	---	---	---
32-----------------------Larton	IIIe	25	20	40	---
33-----------------------Larton	IVe	20	---	30	---
34-----------------------Larton	VIe	---	---	---	---
35-----------------------Latanier	IIIw	35	35	65	4.0
36-----------------------Lightning	IIIw	25	20	45	3.5

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Wheat	Soybeans	Grain sorghum	Alfalfa hay
		Bu	Bu	Bu	Tons
37. Linker	IIe	25	20	40	---
38. Linker	IIIe	20	15	35	---
39. Mason	I	45	40	70	5.0
40. Mason	IIe	40	35	70	4.5
41. Muldrow	IIw	35	35	60	4.0
42. Norwood	I	45	40	70	5.0
43. Oil-waste land	VIIIs	---	---	---	---
44. Okay	I	40	35	65	4.0
45. Okay	IIe	35	30	60	3.5
46. Okemah	I	40	30	60	4.0
47. Oktaha	IIe	25	25	55	3.0
48. Oktaha	IIIe	20	20	50	---
49. Oktaha	IIIe	15	---	---	---
50. Oktaha-Hector	IVe	---	---	---	---
51. Osage	IIIw	35	30	55	4.0
52. Parsons	IIs	35	25	50	---
53. Parsons	IIIe	30	20	45	---
54. Parsons	IVe	20	---	40	---
55. Parsons-Carytown	IIIs	15	15	35	---
56. Pits	VIIs	---	---	---	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Wheat	Soybeans	Grain sorghum	Alfalfa hay
		Bu	Bu	Bu	Tons
57----------------------- Roebuck	IIIw	40	35	60	4.0
58----------------------- Roebuck	IIIw	35	30	55	4.0
59----------------------- Roebuck	Vw	---	---	---	---
60----------------------- Roxana	I	40	35	65	4.5
61----------------------- Roxana	IIe	40	35	65	4.0
62----------------------- Severn	I	40	35	65	4.5
63----------------------- Severn	IIIe	35	30	55	3.5
64----------------------- Shermore	IIIe	20	---	45	---
65:					
Shidler-----------------	VIIs	---	---	---	---
Rock outcrop------------	VIIIs	---	---	---	---
66----------------------- Spiro	IIe	30	25	40	3.0
67----------------------- Stigler	IIw	30	25	55	4.0
68----------------------- Stigler	IIe	25	20	50	3.5
69. Stigler-Urban land					
70----------------------- Taloka	IIw	35	30	60	4.0
71----------------------- Taloka	IIe	30	25	55	3.5
72. Taloka-Urban land					
73----------------------- Tullahassee	Vw	---	---	---	---
74. Urban land					
75----------------------- Verdigris	I	45	40	70	5.0
76----------------------- Verdigris	IIw	40	35	65	4.5

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Wheat	Soybeans	Grain sorghum	Alfalfa hay
		Bu	Bu	Bu	Tons
77------------------------ Verdigris	Vw	---	---	---	---
78------------------------ Woodson	IIs	35	25	55	3.0

TABLE 7.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
2, 3, 4------------------ Bates	Loamy Prairie--------------------------	7,000	5,500	4,500
5, 6:				
Bates------------------	Loamy Prairie--------------------------	7,000	5,500	4,500
Coweta------------------	Shallow Prairie------------------------	3,500	2,300	1,500
7----------------------- Caspiana	Loamy Bottomland----------------------	11,000	9,000	7,600
8----------------------- Choska	Loamy Bottomland----------------------	10,000	8,800	8,000
9----------------------- Choteau	Loamy Prairie--------------------------	7,000	5,200	4,000
10---------------------- Coweta	Shallow Prairie------------------------	3,500	2,300	1,500
11---------------------- Cupco	Loamy Bottomland----------------------	5,500	4,000	3,000
12, 13, 14-------------- Dennis	Loamy Prairie--------------------------	7,000	5,500	4,500
15---------------------- Dennis	Eroded Prairie-------------------------	5,400	4,400	3,600
17:				
Dennis------------------	Loamy Prairie--------------------------	5,400	4,400	3,600
Verdigris---------------	Loamy Bottomland----------------------	10,000	8,500	6,000
18:				
Enders------------------	Loamy Savannah------------------------	4,000	3,000	2,000
Linker------------------	Sandy Savannah------------------------	4,000	3,100	2,000
Hector------------------	Shallow Savannah----------------------	3,000	2,000	1,400
19:				
Endsaw------------------	Savannah Breaks-----------------------	3,600	2,600	2,000
Hector------------------	Savannah Breaks-----------------------	2,000	1,200	700
20:				
Eram--------------------	Loamy Prairie--------------------------	6,000	4,200	3,000
Coweta------------------	Shallow Prairie------------------------	3,500	2,300	1,500
Rock outcrop.				
21---------------------- Garton	Loamy Bottomland----------------------	7,500	5,700	4,500
22, 23------------------ Glenpool	Deep Sand Savannah--------------------	4,000	2,800	2,000

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
24, 25 Kamie	Sandy Savannah	4,500	3,300	2,500
26 Kamie	Eroded Sandy Savannah	2,500	1,600	1,250
28 Keo	Loamy Bottomland	10,000	8,800	8,000
29, 30, 31 Kiomatia	Sandy Bottomland	5,000	4,000	2,500
32, 33 Larton	Deep Sand Savannah	4,000	2,800	2,000
34 Larton	Eroded Sandy Savannah	2,500	1,600	1,250
35 Latanier	Heavy Bottomland	7,100	4,700	3,100
36 Lightning	Heavy Bottomland	5,800	4,200	3,200
37, 38 Linker	Sandy Savannah	4,800	3,700	3,000
39, 40 Mason	Loamy Bottomland	11,500	9,400	8,000
41 Muldrow	Heavy Bottomland	8,000	6,200	5,000
42 Norwood	Loamy Bottomland	10,000	8,500	6,000
44, 45 Okay	Loamy Prairie	7,000	5,500	4,500
46 Okemah	Loamy Prairie	7,000	5,500	4,500
47, 48, 49 Oktaha	Sandy Savannah	4,000	3,100	2,500
50:				
Oktaha	Sandy Savannah	4,000	3,100	2,500
Hector	Shallow Savannah	3,000	2,000	1,400
51 Osage	Heavy Bottomland	9,000	8,000	6,000
52, 53, 54 Parsons	Claypan Prairie	4,500	3,000	2,000
55:				
Parsons	Claypan Prairie	4,500	3,000	2,000
Carytown	Shallow Claypan	3,800	2,600	1,800

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
57, 58, 59-------------- Roebuck	Heavy Bottomland----------------------	7,000	4,600	3,000
60, 61------------------ Roxana	Loamy Bottomland----------------------	10,000	8,800	8,000
62, 63------------------ Severn	Loamy Bottomland----------------------	10,000	8,800	8,000
64---------------------- Shermore	Sandy Savannah------------------------	4,200	2,800	1,800
65:				
Shidler-----------------	Very Shallow--------------------------	2,200	1,200	500
Rock outcrop.				
66---------------------- Spiro	Loamy Prairie-------------------------	6,500	4,700	3,500
67, 68------------------ Stigler	Loamy Savannah------------------------	5,000	3,500	2,500
70, 71------------------ Taloka	Loamy Prairie-------------------------	6,800	5,100	4,000
73---------------------- Tullahassee	Subirrigated--------------------------	10,000	7,600	6,000
75, 76, 77-------------- Verdigris	Loamy Bottomland----------------------	10,000	8,500	6,000
78---------------------- Woodson	Claypan Prairie-----------------------	4,600	3,100	2,100

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1 Barge	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, erodes easily.	Severe: slope.
2, 3, 4 Bates	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: thin layer.
5, 6:					
Bates	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: thin layer.
Coweta	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
7 Caspiana	Slight	Slight	Slight	Severe: erodes easily.	Slight.
8 Choska	Severe: flooding.	Slight	Slight	Severe: erodes easily.	Slight.
9 Choteau	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
10 Coweta	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
11 Cupco	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
12, 13, 14, 15 Dennis	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
16:					
Dennis	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: erodes easily.	Slight.
Urban land.					
17:					
Dennis	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
Verdigris	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
18:					
Enders	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, erodes easily.	Severe: slope.
Linker	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Hector	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
19:					
Endsaw	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: large stones, slope.
Hector	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, large stones, slope.
20:					
Eram	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Slight	Moderate: slope, thin layer.
Coweta	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
Rock outcrop.					
21 Garton	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: erodes easily.	Slight.
22 Glenpool	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
23 Glenpool	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty.
24, 25, 26 Kamie	Slight	Slight	Moderate: slope.	Slight	Slight.
27 Kanima	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: droughty, slope.
28 Keo	Severe: flooding.	Slight	Slight	Slight	Slight.
29 Kiomatia	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
30 Kiomatia	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
31: Kiomatia	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
32: Larton	Slight	Slight	Slight	Slight	Moderate: droughty.
33: Larton	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
34: Larton	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
35: Latanier	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
36: Lightning	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
37, 38: Linker	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: thin layer.
39: Mason	Severe: flooding.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
40: Mason	Severe: flooding.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
41: Muldrow	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
42: Norwood	Severe: flooding.	Slight	Slight	Slight	Slight.
43. Oil-waste land					
44: Okay	Slight	Slight	Slight	Severe: erodes easily.	Slight.
45: Okay	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
46: Okemah	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: erodes easily.	Slight.
47, 48, 49: Oktaha	Slight	Slight	Moderate: depth to rock, small stones.	Slight	Moderate: depth to rock.
50: Oktaha	Slight	Slight	Moderate: depth to rock, small stones.	Slight	Moderate: depth to rock.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
50:					
Hector	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
51 Osage	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.
52, 53, 54 Parsons	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
55:					
Parsons	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
Carytown	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, erodes easily.	Severe: excess sodium, wetness.
56. Pits					
57, 58, 59 Roebuck	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, flooding, percs slowly.	Severe: too clayey.	Severe: too clayey, flooding.
60 Roxana	Severe: flooding.	Slight	Slight	Severe: erodes easily.	Slight.
61 Roxana	Severe: flooding.	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
62 Severn	Severe: flooding.	Slight	Slight	Severe: erodes easily.	Slight.
63 Severn	Severe: flooding.	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
64 Shermore	Moderate: percs slowly, wetness.	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly, slope.	Severe: erodes easily.	Moderate: wetness, droughty.
65:					
Shidler	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: large stones.	Severe: large stones, thin layer.
Rock outcrop.					
66 Spiro	Slight	Slight	Moderate: slope, depth to rock.	Severe: erodes easily.	Moderate: thin layer.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
67, 68 Stigler	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
69: Stigler	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
Urban land.					
70, 71 Taloka	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
72: Taloka	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
Urban land.					
73 Tullahassee	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
74. Urban land					
75 Verdigris	Severe: flooding.	Slight	Slight	Slight	Slight.
76 Verdigris	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
77 Verdigris	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
78 Woodson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
1: Barge	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
2, 3, 4: Bates	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
5, 6:										
Bates	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Coweta	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
7: Caspiana	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
8: Choska	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
9: Choteau	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
10: Coweta	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
11: Cupco	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
12: Dennis	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
13, 14, 15: Dennis	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
16:										
Dennis	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Urban land.										
17:										
Dennis	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Verdigris	Poor	Fair	Fair	Good	Good	Poor	Fair	Fair	Good	Poor.
18:										
Enders	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Linker	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Hector	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
19:										
Endsaw	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Hector	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
20:										
Eram	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Coweta	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Rock outcrop.										
21 Garton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
22, 23 Glenpool	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
24, 25 Kamie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
26 Kamie	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
27 Kanima	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
28 Keo	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
29, 30, 31 Kiomatia	Poor	Fair	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.
32, 33, 34 Larton	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35 Latanier	Fair	Fair	Fair	Good	---	Good	Good	Fair	Good	Good.
36 Lightning	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
37, 38 Linker	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
39, 40 Mason	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
41 Muldrow	Fair	Good	Fair	Good	Good	Fair	Good	Fair	Good	Fair.
42 Norwood	Good	Good	Fair	---	---	Poor	Very poor.	Good	---	Very poor.
43. Oil-waste land										

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
44, 45------------ Okay	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
46---------------- Okemah	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
47, 48, 49--------- Oktaha	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
50:										
Oktaha------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hector------------	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.
51---------------- Osage	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
52---------------- Parsons	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
53, 54------------ Parsons	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
55:										
Parsons-----------	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Carytown----------	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
56. Pits										
57---------------- Roebuck	Fair	Fair	Poor	Good	Good	Poor	Fair	Poor	Fair	Poor.
58---------------- Roebuck	Fair	Fair	Poor	Good	Good	Poor	Fair	Poor	Fair	Poor.
59---------------- Roebuck	Poor	Fair	Poor	Good	Good	Poor	Fair	Poor	Fair	Poor.
60, 61------------ Roxana	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
62, 63------------ Severn	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
64---------------- Shermore	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
65:										
Shidler-----------	Very poor.	Very poor.	Poor	---	---	Very poor.	Very poor.	Very poor.	---	Very poor.
Rock outcrop.										
66---------------- Spiro	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
67, 68----------- Stigler	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
69:										
Stigler-----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Urban land.										
70----------------- Taloka	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
71----------------- Taloka	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
72:										
Taloka------------	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
Urban land.										
73----------------- Tullahassee	Very poor.	Poor	Poor	Good	Good	Fair	Poor	Poor	Fair	Poor.
74. Urban land										
75, 76------------- Verdigris	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
77----------------- Verdigris	Poor	Fair	Fair	Good	Good	Poor	Fair	Fair	Good	Poor.
78----------------- Woodson	Good	Good	Fair	Poor	Poor	Poor	Good	Fair	Fair	Fair.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1----------------- Barge	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
2----------------- Bates	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: low strength.	Moderate: thin layer.
3----------------- Bates	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.	Moderate: thin layer.
4----------------- Bates	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: low strength.	Moderate: thin layer.
5: Bates------------	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: low strength.	Moderate: thin layer.
Coweta-----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Severe: thin layer.
6: Bates------------	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.	Moderate: thin layer.
Coweta-----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.	Severe: thin layer.
7----------------- Caspiana	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
8----------------- Choska	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
9----------------- Choteau	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
10---------------- Coweta	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, low strength.	Severe: thin layer.
11---------------- Cupco	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
12, 13, 14, 15---- Dennis	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
16:						
Dennis	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Urban land.						
17:						
Dennis	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Verdigris	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
18:						
Enders	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Linker	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hector	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
19:						
Endsaw	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: large stones, slope.
Hector	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, large stones, slope.
20:						
Eram	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
Coweta	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, low strength.	Severe: thin layer.
Rock outcrop.						
21 Garton	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
22 Glenpool	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
23---------------- Glenpool	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
24---------------- Kamie	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
25, 26------------ Kamie	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.	Slight.
27---------------- Kanima	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
28---------------- Keo	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
29---------------- Kiomatia	Severe: flooding, cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
30---------------- Kiomatia	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
31---------------- Kiomatia	Severe: flooding, cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
32---------------- Larton	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
33, 34------------ Larton	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
35---------------- Latanier	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
36---------------- Lightning	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness.
37---------------- Linker	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: thin layer.
38---------------- Linker	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Moderate: thin layer.
39, 40------------ Mason	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
41---------------- Muldrow	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness.
42---------------- Norwood	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
43. Oil-waste land						
44, 45 Okay	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
46 Okemah	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
47 Oktaha	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Moderate: depth to rock.
48 Oktaha	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, low strength.	Moderate: depth to rock.
49 Oktaha	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Moderate: depth to rock.
50: Oktaha	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Moderate: depth to rock.
Hector	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
51 Osage	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness.	Severe: wetness.
52, 53, 54 Parsons	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
55: Parsons	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Carytown	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: excess sodium, wetness.
56. Pits						
57 Roebuck	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey, flooding.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
58, 59----------- Roebuck	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: too clayey, flooding.
60, 61----------- Roxana	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
62, 63----------- Severn	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
64--------------- Shermore	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: wetness, droughty.
65:						
Shidler----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, thin layer.
Rock outcrop.						
66--------------- Spiro	Moderate: depth to rock, wetness.	Moderate: shrink-swell.	Moderate: wetness, depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: thin layer.
67, 68----------- Stigler	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Slight.
69:						
Stigler----------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Slight.
Urban land.						
70, 71----------- Taloka	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: low strength.	Moderate: wetness.
72:						
Taloka-----------	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: low strength.	Moderate: wetness.
Urban land.						
73--------------- Tullahassee	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
74. Urban land						
75--------------- Verdigris	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Slight.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
76---------------- Verdigris	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
77---------------- Verdigris	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
78---------------- Woodson	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Barge	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
2, 3, 4 Bates	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
5, 6:					
Bates	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Coweta	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
7 Caspiana	Moderate: percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Fair: too clayey.
8 Choska	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Good.
9 Choteau	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
10 Coweta	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
11 Cupco	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
12, 13, 14, 15 Dennis	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
16:					
Dennis	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Urban land					
17:					
Dennis	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Verdigris	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
18:					
Enders	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Linker	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
Hector	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
19:					
Endsaw	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Hector	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, thin layer, slope.
20:					
Eram	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Coweta	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Rock outcrop.					
21 Garton	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: flooding, wetness.	Poor: too clayey, hard to pack.
22 Glenpool	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
23 Glenpool	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
24, 25, 26 Kamie	Moderate: percs slowly.	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
27 Kanima	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
28 Keo	Moderate: flooding, percs slowly.	Severe: seepage, flooding.	Severe: seepage.	Moderate: flooding.	Good.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
29 Kiomatia	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy.
30 Kiomatia	Severe: wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: too sandy.
31 Kiomatia	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy.
32, 33 Larton	Slight	Severe: seepage.	Slight	Severe: seepage.	Good.
34 Larton	Slight	Severe: seepage, slope.	Slight	Severe: seepage.	Good.
35 Latanier	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
36 Lightning	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
37, 38 Linker	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
39, 40 Mason	Severe: percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
41 Muldrow	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
42 Norwood	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
43. Oil-waste land					
44, 45 Okay	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
46 Okemah	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
47, 48, 49 Oktaha	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, thin layer.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
50:					
Oktaha	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, thin layer.
Hector	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, small stones, thin layer.
51 Osage	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
52, 53, 54 Parsons	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
55:					
Parsons	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Carytown	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
56. Pits					
57 Roebuck	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
58, 59 Roebuck	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
60, 61 Roxana	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
62, 63 Severn	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
64 Shermore	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
65:					
Shidler	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	
Rock outcrop.					

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
66------------------ Spiro	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
67------------------ Stigler	Severe: wetness, percs slowly.	Slight-----------	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
68------------------ Stigler	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
69:					
Stigler------------	Severe: wetness, percs slowly.	Slight-----------	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Urban land.					
70, 71-------------- Taloka	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
72:					
Taloka-------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					
73------------------ Tullahassee	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
74. Urban land					
75------------------ Verdigris	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
76, 77-------------- Verdigris	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
78------------------ Woodson	Severe: percs slowly, wetness.	Slight-----------	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness, hard to pack.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1: Barge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
2, 3, 4: Bates	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
5, 6:				
Bates	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Coweta	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
7: Caspiana	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
8: Choska	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
9: Choteau	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
10: Coweta	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
11: Cupco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
12, 13, 14, 15: Dennis	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, thin layer.
16:				
Dennis	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, thin layer.
Urban land.				
17:				
Dennis	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, thin layer.
Verdigris	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
18:				
Enders	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Linker	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Hector	Poor: area reclaim, slope, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
19:				
Endsaw	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Hector	Poor: area reclaim, slope, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
20:				
Eram	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Coweta	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Rock outcrop.				
21 Garton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
22, 23 Glenpool	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
24, 25, 26 Kamie	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
27 Kanima	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
28 Keo	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
29 Kiomatia	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
30, 31 Kiomatia	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
32, 33, 34----------- Larton	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
35------------------- Latanier	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
36------------------- Lightning	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
37, 38--------------- Linker	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
39, 40--------------- Mason	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41------------------- Muldrow	Poor: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
42------------------- Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
43. Oil-waste land				
44, 45--------------- Okay	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
46------------------- Okemah	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
47, 48, 49----------- Oktaha	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
50: Oktaha---------------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
Hector---------------	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
51------------------- Osage	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
52, 53, 54----------- Parsons	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
55:				
Parsons	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Carytown	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
56. Pits				
57, 58, 59 Roebuck	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
60, 61 Roxana	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
62, 63 Severn	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
64 Shermore	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
65:				
Shidler	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
Rock outcrop.				
66 Spiro	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
67, 68 Stigler	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
69:				
Stigler	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				
70, 71 Taloka	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
72:				
Taloka	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
73-------------------- Tullahassee	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
74. Urban land				
75, 76, 77------------ Verdigris	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
78-------------------- Woodson	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1------------------- Barge	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
2------------------- Bates	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
3, 4--------------- Bates	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
5:						
Bates------------	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
Coweta-----------	Severe: depth to rock.	Severe: piping, thin layer.	Deep to water	Depth to rock	Large stones, depth to rock.	Large stones, depth to rock.
6:						
Bates------------	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
Coweta-----------	Severe: depth to rock.	Severe: piping, thin layer.	Deep to water	Depth to rock, slope.	Large stones, depth to rock.	Large stones, depth to rock.
7------------------- Caspiana	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
8------------------- Choska	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
9------------------- Choteau	Slight---------	Moderate: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
10----------------- Coweta	Severe: depth to rock, slope.	Severe: piping, thin layer.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
11----------------- Cupco	Slight---------	Severe: wetness.	Flooding-------	Wetness, flooding.	Wetness--------	Wetness.
12----------------- Dennis	Slight---------	Moderate: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
13, 14, 15-------- Dennis	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
16:						
Dennis	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
Urban land.						
17:						
Dennis	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
Verdigris	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.
18:						
Enders	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Linker	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Hector	Severe: depth to rock, slope.	Severe: thin layer, piping.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
19:						
Endsaw	Severe: slope.	Moderate: thin layer, hard to pack, large stones.	Deep to water	Droughty, percs slowly, slope.	Slope, large stones.	Large stones, slope.
Hector	Severe: depth to rock, slope, seepage.	Severe: thin layer, piping.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
20:						
Eram	Severe: slope.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, depth to rock, slope.	Wetness, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Coweta	Severe: depth to rock, slope.	Severe: piping, thin layer.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.						
21 Garton	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
22 Glenpool	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy	Droughty.
23 Glenpool	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Too sandy	Droughty.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
24 Kamie	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
25, 26 Kamie	Moderate: seepage, slope.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
27 Kanima	Severe: slope.	Slight	Deep to water	Droughty, slope.	Slope	Slope, droughty.
28 Keo	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
29 Kiomatia	Severe: seepage.	Severe: seepage, piping.	Deep to water	Flooding, droughty.	Too sandy	Droughty.
30 Kiomatia	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty	Too sandy	Droughty.
31 Kiomatia	Severe: seepage.	Severe: seepage, piping.	Deep to water	Flooding, droughty.	Too sandy	Droughty.
32 Larton	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake.	Favorable	Droughty.
33, 34 Larton	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake, slope.	Favorable	Droughty.
35 Latanier	Moderate: seepage.	Severe: piping, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
36 Lightning	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
37 Linker	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
38 Linker	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
39, 40 Mason	Slight	Moderate: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
41 Muldrow	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
42 Norwood	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
43. Oil-waste land						

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
44, 45 Okay	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
46 Okemah	Moderate: seepage.	Severe: hard to pack.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
47 Oktaha	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
48, 49 Oktaha	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
50:						
Oktaha	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
Hector	Severe: depth to rock.	Severe: thin layer, piping.	Deep to water	Droughty, depth to rock, slope.	Depth to rock	Droughty, depth to rock.
51 Osage	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness	Wetness, percs slowly.	Wetness, percs slowly.
52, 53, 54 Parsons	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
55:						
Parsons	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Carytown	Slight	Severe: hard to pack, wetness, excess sodium.	Percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, excess sodium, erodes easily.
56. Pits						
57 Roebuck	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
58, 59 Roebuck	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Percs slowly	Percs slowly.
60, 61 Roxana	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
62 Severn	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
63 Severn	Severe: seepage.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
64 Shermore	Moderate: seepage, slope.	Moderate: piping, wetness.	Slope	Wetness, droughty, rooting depth.	Wetness, rooting depth, erodes easily.	Droughty, rooting depth, erodes easily.
65:						
Shidler	Severe: depth to rock.	Severe: thin layer.	Deep to water	Large stones, depth to rock, slope.	Large stones, depth to rock.	Large stones, depth to rock.
Rock outcrop.						
66 Spiro	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
67, 68 Stigler	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
69:						
Stigler	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
Urban land.						
70, 71 Taloka	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
72:						
Taloka	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Urban land.						
73 Tullahassee	Severe: seepage.	Severe: piping, wetness.	Flooding	Wetness, fast intake, flooding.	Wetness	Wetness.
74. Urban land						
75 Verdigris	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
76, 77 Verdigris	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.
78 Woodson	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Percs slowly, wetness, erodes easily.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated. Some soils may have Unified classifications and USDA textures in addition to those shown. In general, the dominant classifications and textures are shown, and the others are inferred]

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
1----------------- Barge	0-7	Silt loam---------	CL, ML, CL-ML	A-6, A-4	0	100	100	94-100	51-97	20-37	2-13
	7-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
2, 3, 4---------- Bates	0-20	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	80-100	55-90	20-40	3-15
	20-35	Loam, clay loam, sandy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	0	85-100	85-100	80-100	45-85	25-45	3-20
	35-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
5: Bates-----------	0-10	Fine sandy loam	ML, SM	A-4	0	90-100	85-100	80-100	40-55	<30	NP-5
	10-25	Loam, clay loam, sandy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	0	85-100	85-100	80-100	45-85	25-45	3-20
	25-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Coweta----------	0-8	Fine sandy loam	SM-SC, CL-ML, SM, ML	A-2, A-4	0-15	90-100	85-100	80-90	25-60	<26	NP-7
	8-15	Gravelly fine sandy loam, gravelly clay loam, gravelly loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	60-95	55-90	50-90	20-80	15-35	2-15
	15-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
6: Bates-----------	0-14	Fine sandy loam	ML, SM	A-4	0	90-100	85-100	80-100	40-55	<30	NP-5
	14-24	Loam, clay loam, sandy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	0	85-100	85-100	80-100	45-85	25-45	3-20
	24-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Coweta----------	0-8	Fine sandy loam	SM-SC, CL-ML, SM, ML	A-2, A-4	0-15	90-100	85-100	80-90	25-60	<26	NP-7
	8-15	Gravelly fine sandy loam, gravelly clay loam, gravelly loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	60-95	55-90	50-90	20-80	15-35	2-15
	15-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
7----------------- Caspiana	0-18	Silt loam---------	CL-ML, ML	A-4	0	100	100	100	85-100	<27	NP-7
	18-48	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7-6, A-4	0	100	100	100	85-100	23-43	4-20
	48-71	Silt loam, very fine sandy loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	100	80-100	23-37	4-15

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8----------------Choska	0-14	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	94-100	51-97	<31	NP-10
	14-50	Silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4	0	100	100	94-100	51-97	<31	NP-9
	50-67	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
9----------------Choteau	0-24	Loam-------------	CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	24-36	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
	36-62	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
10---------------Coweta	0-8	Fine sandy loam	SM-SC, CL-ML, SM, ML	A-2, A-4	0-15	90-100	85-100	80-90	25-60	<26	NP-7
	8-16	Gravelly fine sandy loam, gravelly clay loam, gravelly loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	60-95	55-90	50-90	20-80	15-35	2-15
	16-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
11---------------Cupco	0-14	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	96-100	80-97	25-37	5-13
	14-45	Silty clay loam	CL	A-6, A-7	0	100	100	98-100	90-98	33-42	12-19
	45-75	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
12, 13, 14, 15---Dennis	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
	14-24	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	24-65	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
16:											
Dennis-----------	0-15	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
	15-24	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	24-62	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
Urban land.											
17:											
Dennis-----------	0-10	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
	10-16	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	16-72	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
Verdigris--------	0-14	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	65-100	22-38	2-13
	14-34	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	65-100	22-40	2-20
	34-62	Silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	8-23

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
18:											
Enders	0-6	Loam	ML, SM, SM-SC, CL-ML	A-4	0	80-100	80-97	75-90	40-85	20-35	2-10
	6-26	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	26-58	Silty clay, shaly silty clay, clay.	CH	A-7	0	95-100	90-100	85-100	70-95	65-80	35-45
	58-72	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---
Linker	0-6	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	70-100	40-70	<30	NP-7
	6-22	Fine sandy loam, sandy clay loam, loam.	CL, SC, SM, ML	A-4, A-6	0-10	70-100	55-100	70-100	40-80	<40	NP-18
	22-36	Gravelly sandy clay loam, gravelly fine sandy loam, sandy clay loam.	CL, SC, GC, ML	A-4, A-6	0-10	50-100	40-100	35-100	30-80	<40	NP-18
	36-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hector	0-6	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	80-100	80-100	80-100	30-65	<30	NP-7
	6-16	Fine sandy loam, gravelly fine sandy loam, gravelly loam.	SM, ML, GM, GM-GC	A-4, A-2	0-15	55-100	55-100	45-100	30-65	<30	NP-7
	16-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
19:											
Endsaw	0-9	Stony fine sandy loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	15-35	65-95	60-90	50-80	20-55	<26	NP-7
	9-42	Silty clay, clay	CL, CH	A-7	0-15	75-100	70-98	68-96	65-95	41-60	18-32
	42-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hector	0-9	Stony fine sandy loam.	SM, ML, GM, GM-GC	A-4, A-2	15-35	60-85	50-75	40-65	30-55	<30	NP-7
	9-15	Fine sandy loam, gravelly fine sandy loam, gravelly loam.	SM, ML, GM, GM-GC	A-4, A-2	0-20	55-100	55-100	45-100	30-65	<30	NP-7
	15-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
20:											
Eram	0-10	Silt loam	CL	A-4, A-6	0	85-100	85-100	85-100	75-95	30-37	8-13
	10-30	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	15-35
	30-40	Weathered bedrock	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
20: Coweta----------	0-7	Fine sandy loam	SM-SC, CL-ML, SM, ML	A-2, A-4	0-15	90-100	85-100	80-90	25-60	<26	NP-7
	7-13	Gravelly fine sandy loam, gravelly clay loam, gravelly loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	60-95	55-90	50-90	20-80	15-35	2-15
	13-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
21--------------- Garton	0-11	Silt loam--------	CL	A-4, A-6	0	100	100	96-100	65-97	30-40	8-14
	11-55	Silty clay loam, clay, silty clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-60	15-33
	55-70	Loam, clay loam, silty clay loam.	CL	A-4, A-6, A-7	0	98-100	98-100	96-100	75-90	30-45	9-21
22, 23----------- Glenpool	0-52	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
	52-99	Loamy fine sand	SM	A-2, A-4	0	100	98-100	90-100	15-45	<26	NP-4
24, 25, 26------- Kamie	0-11	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	11-50	Sandy clay loam, clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	50-65	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
27--------------- Kanima	0-4	Shaly silty clay loam.	CL, SC	A-6	0-10	50-75	50-75	50-75	40-75	33-40	12-18
	4-72	Very shaly clay loam, very shaly silty clay loam, very shaly loam.	GC, GP-GC	A-2, A-4, A-6	0-10	5-50	5-50	5-50	5-49	30-40	8-18
28--------------- Keo	0-9	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	95-100	80-95	<30	NP-7
	9-71	Silt loam, fine sandy loam, silty clay loam.	ML, CL, SM, CL-ML	A-4, A-6, A-2	0	100	100	70-100	25-95	<40	NP-15
29--------------- Kiomatia	0-10	Loamy fine sand	SM	A-4, A-2-4	0	100	95-100	80-100	30-45	---	NP
	10-62	Stratified fine sand to loam.	SM, SM-SC	A-2-4	0	100	95-100	80-90	13-30	<22	NP-5
30--------------- Kiomatia	0-16	Fine sandy loam	SM-SC	A-4, A-2-4	0	100	95-100	80-100	30-45	18-26	4-7
	16-60	Stratified fine sand to loam.	SM, SM-SC	A-2-4	0	100	95-100	80-90	13-30	<22	NP-5
31--------------- Kiomatia	0-8	Fine sandy loam	SM-SC	A-4, A-2-4	0	100	95-100	80-100	30-45	18-26	4-7
	8-60	Stratified fine sand to loam.	SM, SM-SC	A-2-4	0	100	95-100	80-90	13-30	<22	NP-5
32, 33, 34------- Larton	0-28	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	28-69	Fine sandy loam, loam, sandy clay loam.	SM, ML, SC	A-4	0	100	98-100	94-100	36-85	<31	NP-10

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
35--------------- Latanier	0-11	Silty clay loam	CL	A-6, A-7-6	0	100	100	100	95-100	33-42	13-20
	11-35	Clay, silty clay	CH	A-7-6	0	100	100	100	95-100	51-75	26-45
	35-71	Silt loam, silty clay loam, very fine sandy loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	100	80-100	<40	NP-17
36--------------- Lightning	0-14	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	85-98	30-40	8-17
	14-80	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	90-99	37-70	15-40
37, 38----------- Linker	0-12	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	70-100	40-70	<30	NP-7
	12-39	Fine sandy loam, sandy clay loam, loam.	CL, SC, SM, ML	A-4, A-6	0-10	70-100	55-100	70-100	40-80	<40	NP-18
	39-50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
39, 40----------- Mason	0-14	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	65-98	30-37	8-13
	14-62	Silty clay loam, clay loam, silt loam.	CL	A-6, A-4, A-7	0	98-100	98-100	96-100	65-98	30-43	9-20
41--------------- Muldrow	0-10	Silty clay loam	CL	A-6, A-7-6	0	100	100	96-100	80-98	33-43	12-20
	10-80	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-40
42--------------- Norwood	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	51-90	20-35	4-15
	10-65	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
43. Oil-waste land											
44, 45----------- Okay	0-18	Very fine sandy loam.	CL	A-4, A-6	0	100	100	94-100	65-85	30-35	9-13
	18-45	Clay loam, loam, sandy clay loam.	SC, CL, ML, SM	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	45-65	Loam, sandy clay loam, fine sandy loam.	SM, SC, ML, CL	A-4, A-6	0	100	98-100	90-100	36-90	<34	NP-13
46--------------- Okemah	0-8	Silt loam--------	CL	A-4, A-6	0	98-100	98-100	96-100	80-98	30-37	8-13
	8-42	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	80-99	45-70	19-44
	42-65	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	98-100	98-100	96-100	90-99	48-65	21-38
47, 48, 49------- Oktaha	0-10	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0-5	100	75-100	50-75	25-55	<26	NP-7
	10-20	Loam, sandy clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	100	75-100	50-80	30-60	26-37	4-15
	20-35	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0-5	100	70-100	60-85	45-75	25-40	7-18
	35-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
50:											
Oktaha----------	0-6	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0-5	100	75-100	50-75	25-55	<26	NP-7
	6-24	Loam, sandy clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	100	75-100	50-80	30-60	26-37	4-15
	24-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hector----------	0-17	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	80-100	80-100	80-100	30-65	<30	NP-7
	17-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
51--------------- Osage	0-16	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	16-68	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	100	95-100	40-80	20-50
52, 53, 54------- Parsons	0-11	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	96-100	96-100	80-97	20-37	1-12
	11-65	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	96-100	96-100	80-99	37-70	15-40
55:											
Parsons---------	0-11	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	96-100	96-100	80-97	20-37	1-12
	11-62	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	96-100	96-100	80-99	37-70	15-40
Carytown--------	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	80-95	20-30	5-15
	5-62	Clay, silty clay	CH	A-7	0	100	95-100	90-100	90-100	51-70	30-45
56. Pits											
57, 58----------- Roebuck	0-22	Clay------------	CL, CH	A-6, A-7	0	100	100	96-100	90-99	37-70	15-40
	22-70	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-40
59--------------- Roebuck	0-5	Clay------------	CL, CH	A-6, A-7	0	100	100	96-100	90-99	37-70	15-40
	5-67	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-40
60, 61----------- Roxana	0-7	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-100	50-75	<27	NP-7
	7-60	Silt loam, very fine sandy loam, loamy very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-85	<27	NP-7
62, 63----------- Severn	0-8	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	94-100	65-97	22-31	3-12
	8-60	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
64---------------- Shermore	0-12	Loam-------------	ML, CL, SM, SC	A-4, A-6	0	75-98	75-98	65-85	45-85	22-35	2-13
	12-31	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6, A-2	0	75-98	75-98	60-90	25-90	25-40	8-18
	31-65	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6, A-2	0	85-98	85-98	70-90	30-90	25-40	8-18
65: Shidler---------	0-7	Stony silty clay loam.	CL, CH	A-6, A-7	25-45	55-75	55-75	55-75	51-75	33-55	12-27
	7-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
66---------------- Spiro	0-9	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	94-100	51-97	<31	NP-10
	9-32	Loam, silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	9-20
	32-36	Loam, silt loam, silty clay loam.	CL, GC, GP-GC	A-2, A-4, A-6, A-7	0	15-90	10-85	10-80	6-80	30-43	9-20
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
67, 68----------- Stigler	0-26	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	94-100	60-97	20-37	2-14
	26-80	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
69: Stigler---------	0-18	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	94-100	60-97	20-37	2-14
	18-62	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Urban land.											
70, 71----------- Taloka	0-24	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	80-97	30-37	8-13
	24-65	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
72: Taloka----------	0-22	Silt loam--------	ML, CL	A-4, A-6	0	100	100	96-100	80-97	30-37	8-13
	22-70	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Urban land.											
73---------------- Tullahassee	0-6	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	6-65	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	90-100	36-85	<30	NP-10
74. Urban land											

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
75, 76, 77------- Verdigris	0-15	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	65-100	22-38	2-13
	15-31	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	65-100	22-40	2-20
	31-60	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	8-23
78--------------- Woodson	0-12	Silty clay loam	CL	A-6	0	100	100	90-100	85-100	30-40	10-20
	12-24	Silty clay, clay	CH	A-7-6	0	100	95-100	95-100	90-100	50-65	30-45
	24-70	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0	100	95-100	95-100	90-100	45-65	20-40

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
1----------------- Barge	0-7	15-26	1.30-1.40	0.2-0.6	0.15-0.24	6.1-7.8	Low----------	0.37	5	.5-1
	7-60	18-35	1.45-1.70	0.2-0.6	0.15-0.22	6.1-7.8	Moderate-----	----		
2, 3, 4---------- Bates	0-20	15-27	1.40-1.50	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.28	4	1-4
	20-35	18-35	1.50-1.60	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.28		
	35-60	---	---	---	---	---	-------------	----		
5:										
Bates-----------	0-10	5-15	1.50-1.60	2.0-6.0	0.15-0.18	5.1-6.5	Low----------	0.20	4	1-2
	10-25	18-35	1.50-1.60	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.28		
	25-40	---	---	---	---	---	-------------	----		
Coweta----------	0-8	10-18	1.30-1.60	2.0-6.0	0.09-0.15	5.1-6.5	Low----------	0.24	2	1-3
	8-15	10-30	1.45-1.70	0.6-2.0	0.09-0.18	5.1-6.5	Low----------	0.28		
	15-30	---	---	---	---	---	-------------	----		
6:										
Bates-----------	0-14	5-15	1.50-1.60	2.0-6.0	0.15-0.18	5.1-6.5	Low----------	0.20	4	1-2
	14-24	18-35	1.50-1.60	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.28		
	24-40	---	---	---	---	---	-------------	----		
Coweta----------	0-8	10-18	1.30-1.60	2.0-6.0	0.09-0.15	5.1-6.5	Low----------	0.24	2	1-3
	8-15	10-30	1.45-1.70	0.6-2.0	0.09-0.18	5.1-6.5	Low----------	0.28		
	15-30	---	---	---	---	---	-------------	----		
7---------------- Caspiana	0-18	10-27	1.30-1.65	0.6-2.0	0.21-0.23	5.6-8.4	Low----------	0.37	5	1-4
	18-48	20-35	1.30-1.75	0.6-2.0	0.20-0.22	5.6-8.4	Moderate-----	0.32		
	48-71	10-35	1.30-1.65	0.6-2.0	0.15-0.23	6.1-8.4	Low----------	0.32		
8---------------- Choska	0-14	15-27	1.30-1.55	0.6-2.0	0.13-0.24	6.1-7.8	Low----------	0.37	5	1-3
	14-50	12-18	1.40-1.65	0.6-2.0	0.13-0.24	6.6-8.4	Low----------	0.37		
	50-67	5-12	1.60-1.70	2.0-6.0	0.07-0.11	6.6-8.4	Low----------	0.17		
9---------------- Choteau	0-24	18-24	1.30-1.55	0.6-2.0	0.16-0.20	4.5-6.5	Low----------	0.43	5	1-3
	24-36	27-35	1.45-1.70	0.2-0.6	0.15-0.22	4.5-6.0	Moderate-----	0.37		
	36-62	35-45	1.35-1.70	0.06-0.2	0.12-0.22	5.1-7.8	High---------	0.37		
10--------------- Coweta	0-8	10-18	1.30-1.60	2.0-6.0	0.09-0.15	5.1-6.5	Low----------	0.24	2	1-3
	8-16	10-30	1.45-1.70	0.6-2.0	0.09-0.18	5.1-6.5	Low----------	0.28		
	16-20	---	---	---	---	---	-------------	----		
11--------------- Cupco	0-14	15-26	1.30-1.50	0.6-2.0	0.16-0.24	4.5-6.5	Low----------	0.37	5	.5-2
	14-45	27-35	1.45-1.75	0.2-0.6	0.18-0.22	4.5-6.5	Moderate-----	0.32		
	45-75	27-35	1.45-1.75	0.2-0.6	0.15-0.22	5.1-7.3	Moderate-----	0.32		
12, 13, 14, 15--- Dennis	0-14	10-27	1.30-1.55	0.6-2.0	0.15-0.20	5.1-6.0	Low----------	0.43	5	1-3
	14-24	27-35	1.45-1.70	0.2-0.6	0.15-0.20	4.5-6.0	Moderate-----	0.37		
	24-65	35-55	1.35-1.65	0.06-0.2	0.15-0.20	5.1-8.4	High---------	0.37		
16:										
Dennis----------	0-15	10-27	1.30-1.55	0.6-2.0	0.15-0.20	5.1-6.0	Low----------	0.43	5	1-3
	15-24	27-35	1.45-1.70	0.2-0.6	0.15-0.20	4.5-6.0	Moderate-----	0.37		
	24-62	35-55	1.35-1.65	0.06-0.2	0.15-0.20	5.1-8.4	High---------	0.37		
Urban land.										

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
17:										
Dennis----------	0-10	10-27	1.30-1.55	0.6-2.0	0.15-0.20	5.1-6.0	Low----------	0.43	5	1-3
	10-16	27-35	1.45-1.70	0.2-0.6	0.15-0.20	4.5-6.0	Moderate-----	0.37		
	16-72	35-55	1.35-1.65	0.06-0.2	0.15-0.20	5.1-8.4	High---------	0.37		
Verdigris-------	0-14	15-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	2-4
	14-34	15-30	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32		
	34-62	18-35	1.40-1.45	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.32		
18:										
Enders----------	0-6	10-25	1.25-1.60	0.6-2.0	0.10-0.20	3.6-5.5	Low----------	0.37	3	.5-1
	6-26	35-60	1.15-1.45	<0.06	0.12-0.18	3.6-5.5	High---------	0.37		
	26-58	35-60	1.20-1.45	<0.06	0.08-0.10	3.6-5.5	Moderate-----	0.37		
	58-72	---	---	---	---	---	-------------	----		
Linker----------	0-6	5-20	1.30-1.60	0.6-2.0	0.11-0.20	3.6-5.5	Low----------	0.28	3	.5-3
	6-22	18-35	1.30-1.60	0.6-2.0	0.11-0.20	3.6-5.5	Low----------	0.32		
	22-36	18-35	1.30-1.60	0.6-2.0	0.08-0.20	3.6-5.5	Low----------	0.28		
	36-60	---	---	---	---	---	-------------	----		
Hector----------	0-6	5-20	1.30-1.60	2.0-6.0	0.10-0.14	5.1-6.5	Low----------	0.24	1	.5-1
	6-16	10-25	1.30-1.60	2.0-6.0	0.08-0.15	4.5-5.5	Low----------	0.17		
	16-22	---	---	---	---	---	-------------	----		
19:										
Endsaw----------	0-9	12-20	1.30-1.60	0.6-2.0	0.06-0.14	5.1-6.0	Low----------	0.15	4	.5-1
	9-42	40-60	1.35-1.60	0.06-0.2	0.08-0.18	4.5-5.5	High---------	0.32		
	42-60	---	---	---	---	---	-------------	----		
Hector----------	0-9	5-20	1.30-1.60	2.0-6.0	0.08-0.12	5.1-6.5	Low----------	0.17	1	.5-1
	9-15	10-25	1.30-1.60	2.0-6.0	0.08-0.15	4.5-5.5	Low----------	0.17		
	15-20	---	---	---	---	---	-------------	----		
20:										
Eram------------	0-10	18-27	1.30-1.50	0.2-2.0	0.16-0.24	5.6-6.5	Low----------	0.43	3	1-3
	10-30	35-55	1.45-1.75	0.06-0.2	0.14-0.18	5.1-7.3	High---------	0.37		
	30-40	---	---	---	---	---	-------------	----		
Coweta----------	0-7	10-18	1.30-1.60	2.0-6.0	0.09-0.15	5.1-6.5	Low----------	0.24	2	1-3
	7-13	10-30	1.45-1.70	0.6-2.0	0.09-0.18	5.1-6.5	Low----------	0.28		
	13-30	---	---	---	---	---	-------------	----		
Rock outcrop.										
21--------------- Garton	0-11	20-26	1.30-1.50	0.2-2.0	0.15-0.24	6.1-7.3	Low----------	0.43	5	1-4
	11-55	35-45	1.35-1.65	0.06-0.2	0.12-0.22	6.1-7.8	High---------	0.37		
	55-70	20-35	1.40-1.65	0.2-0.6	0.15-0.20	6.6-7.8	Moderate-----	0.32		
22, 23----------- Glenpool	0-52	5-12	1.35-1.50	6.0-20	0.05-0.11	5.6-6.5	Low----------	0.17	5	.5-1
	52-99	5-12	1.35-1.50	6.0-20	0.07-0.14	4.5-5.5	Low----------	0.20		
24, 25, 26------- Kamie	0-11	10-18	1.30-1.60	2.0-6.0	0.11-0.15	5.6-7.3	Low----------	0.24	5	.5-1
	11-50	20-35	1.35-1.65	0.6-2.0	0.12-0.20	4.5-6.0	Low----------	0.32		
	50-65	18-32	1.35-1.65	0.6-2.0	0.11-0.17	4.5-6.0	Low----------	0.32		
27--------------- Kanima	0-4	27-35	1.30-1.60	0.6-2.0	0.08-0.17	5.6-8.4	Low----------	0.28	4	.5-2
	4-72	18-35	1.40-1.70	0.6-2.0	0.02-0.12	5.6-8.4	Low----------	0.28		
28--------------- Keo	0-9	5-20	1.25-1.60	0.6-2.0	0.13-0.24	6.1-7.8	Low----------	0.43	5	1-4
	9-71	10-30	1.25-1.60	0.6-6.0	0.07-0.24	7.4-8.4	Low----------	0.37		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
29---------------Kiomatia	0-10	5-10	1.30-1.60	0.6-2.0	0.10-0.15	6.1-8.4	Low----------	0.17	5	<1
	10-62	2-15	1.40-1.65	6.0-20	0.05-0.10	6.1-8.4	Low----------	0.17		
30---------------Kiomatia	0-16	10-15	1.30-1.60	0.6-2.0	0.10-0.15	6.1-8.4	Low----------	0.17	5	<1
	16-60	2-15	1.40-1.65	6.0-20	0.05-0.10	6.1-8.4	Low----------	0.17		
31---------------Kiomatia	0-8	10-15	1.30-1.60	0.6-2.0	0.10-0.15	6.1-8.4	Low----------	0.17	5	<1
	8-60	2-15	1.40-1.65	6.0-20	0.05-0.10	6.1-8.4	Low----------	0.17		
32, 33, 34-------Larton	0-28	5-10	1.35-1.50	2.0-6.0	0.07-0.11	5.1-6.5	Low----------	0.20	5	.5-1
	28-69	15-25	1.40-1.70	0.6-2.0	0.11-0.20	4.5-6.0	Low----------	0.24		
35---------------Latanier	0-11	27-35	1.30-1.70	0.06-0.2	0.20-0.22	6.6-8.4	Moderate-----	0.37	5	.5-4
	11-35	40-55	1.20-1.70	<0.06	0.18-0.20	6.6-8.4	Very high----	0.32		
	35-71	10-27	1.30-1.65	0.06-2.0	0.18-0.22	6.6-8.4	Low----------	0.37		
36---------------Lightning	0-14	18-27	1.30-1.50	0.06-0.6	0.16-0.20	5.1-7.3	Moderate-----	0.43	5	.5-1
	14-80	35-55	1.35-1.65	<0.06	0.12-0.20	4.5-8.4	High---------	0.37		
37, 38-----------Linker	0-12	5-20	1.30-1.60	0.6-2.0	0.11-0.20	3.6-5.5	Low----------	0.28	3	.5-3
	12-39	18-35	1.30-1.60	0.6-2.0	0.11-0.20	3.6-5.5	Low----------	0.32		
	39-50	---	---	---	---	---	-------------	----		
39, 40-----------Mason	0-14	12-27	1.30-1.50	0.6-2.0	0.16-0.20	5.1-7.3	Low----------	0.37	5	1-3
	14-62	20-35	1.40-1.70	0.2-0.6	0.16-0.20	4.5-7.8	Moderate-----	0.37		
41---------------Muldrow	0-10	30-40	1.30-1.60	0.2-0.6	0.15-0.22	5.1-6.0	Moderate-----	0.43	5	1-3
	10-80	35-50	1.35-1.65	<0.06	0.12-0.22	6.1-8.4	High---------	0.43		
42---------------Norwood	0-10	10-27	1.30-1.50	0.6-2.0	0.17-0.21	7.4-8.4	Low----------	0.43	5	.5-2
	10-65	10-35	1.30-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low----------	0.43		
43. Oil-waste land										
44, 45-----------Okay	0-18	15-25	1.30-1.55	2.0-6.0	0.15-0.20	5.6-6.5	Low----------	0.37	5	1-3
	18-45	20-35	1.40-1.65	0.6-2.0	0.12-0.18	5.1-6.5	Low----------	0.37		
	45-65	15-27	1.40-1.65	0.6-6.0	0.11-0.17	5.1-7.3	Low----------	0.37		
46---------------Okemah	0-8	20-27	1.30-1.50	0.2-2.0	0.16-0.24	5.6-7.3	Low----------	0.43	5	1-3
	8-42	35-55	1.40-1.65	0.06-0.2	0.15-0.19	5.6-7.8	High---------	0.43		
	42-65	35-55	1.40-1.65	0.06-0.2	0.15-0.19	6.6-8.4	High---------	0.37		
47, 48, 49-------Oktaha	0-10	10-18	1.30-1.60	2.0-6.0	0.09-0.15	4.0-6.5	Low----------	0.20	5	<1
	10-20	15-30	1.35-1.65	0.6-2.0	0.11-0.20	4.0-6.5	Low----------	0.32		
	20-35	18-35	1.35-1.65	0.6-2.0	0.11-0.20	4.0-6.0	Low----------	0.32		
	35-40	---	---	---	---	---	-------------	----		
50:										
Oktaha-----------	0-6	10-18	1.30-1.60	2.0-6.0	0.09-0.15	4.0-6.5	Low----------	0.20	5	<1
	6-24	15-30	1.35-1.65	0.6-2.0	0.11-0.20	4.0-6.5	Low----------	0.32		
	24-40	---	---	---	---	---	-------------	----		
Hector-----------	0-17	5-20	1.30-1.60	2.0-6.0	0.10-0.14	5.1-6.5	Low----------	0.24	1	.5-1
	17-30	---	---	---	---	---	-------------	----		
51---------------Osage	0-16	35-40	1.45-1.65	<0.06	0.21-0.23	5.1-7.3	High---------	0.28	5	1-4
	16-68	35-60	1.50-1.70	<0.06	0.08-0.12	5.6-7.8	Very high----	0.28		
52, 53, 54-------Parsons	0-11	15-25	1.30-1.50	0.6-2.0	0.16-0.24	5.1-6.5	Low----------	0.49	4	.5-1
	11-65	35-60	1.40-1.70	<0.6	0.14-0.22	5.1-7.8	High---------	0.43		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
55:										
Parsons	0-11	15-25	1.30-1.50	0.6-2.0	0.16-0.24	5.1-6.5	Low	0.49	4	.5-1
	11-62	35-60	1.40-1.70	<0.6	0.14-0.22	5.1-7.8	High	0.43		
Carytown	0-5	12-25	1.20-1.40	0.6-2.0	0.19-0.24	5.1-7.3	Low	0.43	3	.5-2
	5-62	40-60	1.45-1.65	<0.06	0.08-0.11	5.6-8.4	High	0.43		
56. Pits										
57, 58 Roebuck	0-22	40-60	1.30-1.60	<0.06	0.12-0.20	6.1-8.4	High	0.32	5	1-3
	22-70	35-60	1.35-1.65	<0.06	0.12-0.20	6.1-8.4	High	----		
59 Roebuck	0-5	40-60	1.30-1.60	<0.06	0.12-0.20	6.1-8.4	High	0.32	5	1-3
	5-67	35-60	1.35-1.65	<0.06	0.12-0.20	6.1-8.4	High	----		
60, 61 Roxana	0-7	5-27	1.35-1.80	0.6-2.0	0.10-0.21	6.1-8.4	Low	0.43	5	.5-2
	7-60	10-18	1.35-1.80	0.6-2.0	0.10-0.19	6.6-8.4	Low	0.37		
62, 63 Severn	0-8	8-17	1.30-1.50	2.0-6.0	0.13-0.20	7.4-8.4	Low	0.37	5	.5-1
	8-60	8-17	1.35-1.60	2.0-6.0	0.11-0.20	7.9-8.4	Low	0.32		
64 Shermore	0-12	15-25	1.30-1.55	0.6-2.0	0.11-0.20	5.1-6.5	Low	0.37	5	.5-2
	12-31	18-35	1.45-1.70	0.6-2.0	0.07-0.15	4.5-6.0	Low	0.37		
	31-65	18-38	1.55-1.75	0.2-0.6	0.05-0.10	4.5-6.0	Low	0.32		
65:										
Shidler	0-7	27-35	1.30-1.60	0.6-2.0	0.10-0.20	6.1-8.4	Moderate	0.28	1	1-5
	7-24	---	---	---	---	---	-------------	----		
Rock outcrop.										
66 Spiro	0-9	12-27	1.30-1.50	0.6-2.0	0.15-0.24	5.1-6.5	Low	0.43	3	.5-1
	9-32	25-35	1.40-1.70	0.6-2.0	0.15-0.24	4.5-6.0	Moderate	0.37		
	32-36	25-35	1.40-1.70	0.6-2.0	0.08-0.12	4.5-6.0	Moderate	0.37		
	36-40	---	---	---	---	---	-------------	----		
67, 68 Stigler	0-26	10-20	1.30-1.55	0.6-2.0	0.13-0.24	4.5-5.5	Low	0.49	5	1-3
	26-80	35-60	1.35-1.65	<0.06	0.12-0.22	4.5-6.0	High	0.43		
69:										
Stigler	0-18	10-20	1.30-1.55	0.6-2.0	0.13-0.24	4.5-5.5	Low	0.49	5	1-3
	18-62	35-60	1.35-1.65	<0.06	0.12-0.22	4.5-6.0	High	0.43		
Urban land.										
70, 71 Taloka	0-24	15-25	1.30-1.50	0.6-2.0	0.16-0.24	5.1-6.0	Low	0.49	5	.5-1
	24-65	35-60	1.40-1.70	<0.06	0.12-0.22	5.1-8.4	High	0.43		
72:										
Taloka	0-22	15-25	1.30-1.50	0.6-2.0	0.16-0.24	5.1-6.0	Low	0.49	5	.5-1
	22-70	35-60	1.40-1.70	<0.06	0.12-0.22	5.1-8.4	High	0.43		
Urban land.										
73 Tullahassee	0-6	5-12	1.35-1.50	2.0-6.0	0.07-0.11	5.6-6.5	Low	0.17	5	.5-1
	6-65	5-18	1.40-1.70	2.0-6.0	0.12-0.16	5.6-6.5	Low	0.20		
74. Urban land										

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH				Pct
75, 76, 77-------- Verdigris	0-15	15-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	5	2-4
	15-31	15-30	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32		
	31-60	18-35	1.40-1.45	0.6-2.0	0.17-0.22	5.6-7.3	Moderate------	0.32		
78--------------- Woodson	0-12	27-32	1.25-1.45	0.2-0.6	0.21-0.23	5.6-6.5	Moderate------	0.43	4	1-4
	12-24	40-60	1.30-1.45	<0.06	0.12-0.15	5.6-7.3	High----------	0.32		
	24-70	30-50	1.35-1.45	0.06-0.2	0.10-0.15	5.6-7.8	High----------	0.32		

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
1----------------- Barge	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
2, 3, 4----------- Bates	B	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate.
5, 6:											
Bates------------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate.
Coweta-----------	C	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate.
7----------------- Caspiana	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
8----------------- Choska	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Low.
9----------------- Choteau	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate.
10---------------- Coweta	C	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate.
11---------------- Cupco	C	Occasional	Very brief to brief.	Jan-Jul	0.5-2.0	Perched	Nov-May	>60	---	High-----	Moderate.
12, 13, 14, 15---- Dennis	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate.
16:											
Dennis-----------	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate.
Urban land.											
17:											
Dennis-----------	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate.
Verdigris--------	B	Frequent----	Very brief	Dec-Jun	>6.0	---	---	>60	---	Low------	Low.
18:											
Enders-----------	C	None--------	---	---	>6.0	---	---	40-60	Soft	High-----	High.
Linker-----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High.
Hector-----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
19:											
Endsaw-----------	C	None--------	---	---	>6.0	---	---	30-60	Soft	High-----	High.
Hector-----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
20:											
Eram-------------	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	20-40	Soft	High-----	Moderate.
Coweta-----------	C	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
20: Rock outcrop.											
21 Garton	C	Rare	---	---	2.0-3.0	Perched	Nov-Apr	>60	---	High	Low.
22, 23 Glenpool	A	None	---	---	>6.0	---	---	>60	---	Low	High.
24, 25, 26 Kamie	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
27 Kanima	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
28 Keo	B	Rare	---	---	>6.0	---	---	>60	---	Low	Low.
29 Kiomatia	A	Frequent	Brief	Feb-Jun	3.0-5.0	Apparent	Jan-Jul	>60	---	Low	Low.
30 Kiomatia	A	Rare	---	---	3.0-5.0	Apparent	Jan-Jul	>60	---	Low	Low.
31 Kiomatia	A	Frequent	Brief	Feb-Jun	3.0-5.0	Apparent	Jan-Jul	>60	---	Low	Low.
32, 33, 34 Larton	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
35 Latanier	D	Rare	---	---	1.0-3.0	Apparent	Dec-Apr	>60	---	High	Low.
36 Lightning	D	Occasional	Very brief	Jan-Jul	0-2.0	Perched	Nov-Apr	>60	---	High	Moderate.
37, 38 Linker	B	None	---	---	>6.0	---	---	20-40	Hard	Low	High.
39, 40 Mason	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
41 Muldrow	D	Rare	---	---	0-2.0	Apparent	Sep-Mar	>60	---	High	Moderate.
42 Norwood	B	Rare	---	---	>6.0	---	---	>60	---	High	Low.
43. Oil-waste land											
44, 45 Okay	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
46 Okemah	C	None	---	---	2.0-3.0	Perched	Nov-Apr	>60	---	High	Moderate.
47, 48, 49 Oktaha	B	None	---	---	>6.0	---	---	20-40	Hard	Low	High.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
50:											
Oktaha	B	None	---	---	>6.0	---	---	20-40	Hard	Low	High.
Hector	D	None	---	---	>6.0	---	---	10-20	Hard	Low	Moderate.
51 Osage	D	Rare	---	---	0-1.0	Apparent	Nov-May	>60	---	High	Moderate.
52, 53, 54 Parsons	D	None	---	---	0.5-1.5	Perched	Dec-Apr	>60	---	High	Moderate.
55:											
Parsons	D	None	---	---	0.5-1.5	Perched	Dec-Apr	>60	---	High	Moderate.
Carytown	D	None	---	---	0-1.0	Perched	Dec-Apr	>60	---	High	Moderate.
56. Pits											
57 Roebuck	D	Rare	---	---	>6.0	---	---	>60	---	High	Low.
58 Roebuck	D	Occasional	Brief to long.	Jan-Jul	>6.0	---	---	>60	---	High	Low.
59 Roebuck	D	Frequent	Brief to very long.	Jan-Jul	>6.0	---	---	>60	---	High	Low.
60, 61 Roxana	B	Rare	---	---	>6.0	---	---	>60	---	Low	Low.
62, 63 Severn	B	Rare	---	---	>6.0	---	---	>60	---	Low	Low.
64 Shermore	B	None	---	---	1.5-3.5	Perched	Nov-Jun	>60	---	Moderate	High.
65:											
Shidler	D	None	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Rock outcrop.											
66 Spiro	B	None	---	---	3.0-4.0	Perched	Feb-Jul	20-40	Soft	Moderate	High.
67, 68 Stigler	D	None	---	---	2.0-3.0	Perched	Nov-Jun	>60	---	High	High.
69:											
Stigler	D	None	---	---	2.0-3.0	Perched	Nov-Jun	>60	---	High	High.
Urban land.											
70, 71 Taloka	D	None	---	---	1.0-2.0	Perched	Nov-Jun	>60	---	High	Moderate.
72:											
Taloka	D	None	---	---	1.0-2.0	Perched	Nov-Jun	>60	---	High	Moderate.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
72: Urban land.											
73----------------- Tullahassee	C	Frequent----	Very brief to long.	Mar-Aug	0.5-3.0	Apparent	Nov-May	>60	---	Moderate	Moderate.
74. Urban land											
75----------------- Verdigris	B	Rare--------	---	---	>6.0	---	---	>60	---	Low-------	Low.
76----------------- Verdigris	B	Occasional	Very brief	Dec-Jun	>6.0	---	---	>60	---	Low-------	Low.
77----------------- Verdigris	B	Frequent----	Very brief	Dec-Jun	>6.0	---	---	>60	---	Low-------	Low.
78----------------- Woodson	D	None--------	---	---	0.5-2.0	Perched	Dec-Apr	>60	---	High------	Moderate.

TABLE 17.--PHYSICAL ANALYSES OF SELECTED SOILS

Soil series and sample number	Depth	Horizon	Particle-size distribution: Very coarse sand (2.0-1.0 mm)	Coarse sand (1.0-0.5 mm)	Medium sand (0.5-0.25 mm)	Fine sand (0.25-0.10 mm)	Very fine sand (0.10-0.05 mm)	Total sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct
Enders loam: 1/ (77-OK-51-15)	0-3	A11	0.8	1.4	5.4	13.9	8.4	29.9	56.5	13.6
	3-6	A12	1.5	1.7	6.1	17.5	11.6	38.4	47.8	13.8
	6-26	B21t	0.3	0.3	0.9	2.1	2.2	5.8	32.8	61.4
	26-45	B22t	0.4	0.7	0.9	1.4	1.3	4.7	37.4	57.9
	45-58	B3	0.5	0.6	0.7	1.0	1.0	3.8	38.2	58.0
Hector fine sandy loam: 2/ (77-OK-51-14)	0-3	A1	0.2	0.5	3.5	8.4	6.0	18.6	70.7	10.7
	3-6	A2	0.9	1.4	10.9	22.5	8.1	43.8	47.0	9.2
	6-14	B2	0.8	1.2	9.7	20.6	7.2	39.5	48.3	12.2
Oktaha fine sandy loam: 3/ (80-OK-51-1)	0-5	Ap	0.3	0.6	29.2	24.8	5.3	60.2	27.7	12.1
	5-10	A2	0.5	0.6	24.4	24.9	4.7	55.1	31.0	13.9
	10-20	B1	0.4	0.5	25.2	22.6	3.7	52.4	32.4	15.2
	20-30	B21t	0.7	0.5	22.7	22.5	2.6	49.0	28.0	23.0
	30-35	B22t	1.5	0.6	19.5	21.4	4.7	47.7	31.4	20.9

1/ Location of the pedon is the same as that described for the series in the section "Soil Series and Their Morphology." This pedon has 1.4 percent more clay (61.4 vs 60.0) in the particle-size control section than the Enders series permits. This is considered to be within the range of sampling error, and the soil is not a taxadjunct. Also, the A11 horizon is slightly higher in silt content than is normal for the Enders series.

2/ Location of the pedon is 1,600 feet east and 250 feet south of the northwest corner of sec. 32, T. 13 N., R. 20 E. The thin A1 horizon in this pedon is higher in silt content than is normal for the Hector series.

3/ Location of the pedon is the same as that described for the series in the section "Soil Series and Their Morphology."

TABLE 18.--CHEMICAL ANAYLSES OF SELECTED SOILS

Soil series and sample number	Depth	Horizon	Extractable bases (milliequivalents per 100 grams of soil)				Cation-exchange capacity	Base Saturation	Reaction 1:1 soil:water	Organic matter	Total phosphorus
			Ca	Mg	K	Na					
	In							Pct	pH	Pct	P/m
Enders loam: 1/ (77-OK-51-15)	0-3	A11	20.10	3.94	0.55	0.09	26.9	91.4	6.6	4.28	564.0
	3-6	A12	1.06	1.06	0.14	0.07	9.3	25.3	5.1	0.46	313.0
	6-26	B21t	3.82	3.86	0.44	0.11	44.0	29.3	4.9	0.42	354.0
	26-45	B22t	3.73	3.22	0.57	0.17	46.4	28.7	4.9	0.36	259.0
	45-58	B3	4.79	3.52	0.57	0.49	44.4	34.5	4.9	0.32	301.0
Hector fine sandy loam: 2/ (77-OK-51-14)	0-3	A1	5.98	1.15	0.22	0.06	13.2	57.1	5.6	3.60	371.0
	3-6	A2	3.59	0.55	0.07	0.06	7.5	56.8	5.9	1.62	256.0
	6-14	B2	2.90	0.32	0.10	0.07	6.5	54.2	5.7	0.83	295.0
Oktaha fine sandy loam: 1/ (80-OK-51-1)	0-5	Ap	1.50	0.56	0.13	0.04	5.3	21.5	5.9	1.81	---
	5-10	A2	1.26	0.45	0.08	0.05	5.8	18.0	5.4	1.42	---
	10-20	B1	1.01	0.75	0.07	0.05	5.4	13.1	5.4	0.82	---
	20-30	B21t	0.52	0.55	0.09	0.05	6.0	7.3	5.2	0.85	---
	30-35	B22t	0.43	0.65	0.10	0.05	7.4	12.3	5.2	0.92	---

1/ Location of the pedon is the same as that described for the series in the section "Soil Series and Their Morphology."

2/ Locaton of the pedon is 1,600 feet east and 250 feet south of the northwest corner of sec. 32, T. 13 N., R. 20 E.

TABLE 19.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution						Liquid limit	Plasticity index	Shrinkage	
			Percentage passing sieve--				Percentage smaller than--					
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.005 mm	.002 mm			Limit	Ratio
									Pct		Pct	Pct
Enders loam: 1/ (77-OK-51-15)												
6-24	A-7 (48)	CH	100	100	99	96	69	63	75	41	12.0	1.90
24-45	A-7 (59)	CH	100	100	98	96	66	59	83	51	16.0	1.84
Hector silt loam: 2/ (77-OK-51-14)												
0-14	A-4 (0)	ML	85	81	78	53	11	7	---	NP	0.0	0.00

1/ Location of the pedon is the same as that described for the series in the section "Soil Series and Their Morphology." Analyses of this pedon indicate that the particle-size control section has 3 percent more clay (63 percent vs. 60 percent) than the Enders series permits. This is considered to be within the range of sampling error, and the soil is not a taxadjunct.

2/ Location of the pedon is 1,600 feet east and 250 feet south of the northwest corner of sec. 32, T. 13 N., R. 20 E.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Barge	Fine-silty, mixed, nonacid, thermic Hapludollic Arents
Bates	Fine-loamy, siliceous, thermic Typic Argiudolls
Carytown	Fine, mixed, thermic Albic Natraqualfs
Caspiana	Fine-silty, mixed, thermic Typic Argiudolls
Choska	Coarse-silty, mixed, thermic Fluventic Hapludolls
Choteau	Fine, mixed, thermic Aquic Paleudolls
Coweta	Loamy, siliceous, thermic, shallow Typic Hapludolls
Cupco	Fine-silty, siliceous, thermic Aeric Ochraqualfs
Dennis	Fine, mixed, thermic Aquic Paleudolls
Enders	Clayey, mixed, thermic Typic Hapludults
Endsaw	Clayey, mixed, thermic Typic Hapludults
Eram	Fine, mixed, thermic Aquic Argiudolls
Garton	Fine, mixed, thermic Aquic Argiudolls
Glenpool	Sandy, siliceous, thermic Psammentic Paleudalfs
Hector	Loamy, siliceous, thermic Lithic Dystrochrepts
Kamie	Fine-loamy, mixed, thermic Typic Paleudalfs
Kanima	Loamy-skeletal, mixed, nonacid, thermic Udalfic Arents
Keo	Coarse-silty, mixed, thermic Dystric Fluventic Eutrochrepts
Kiomatia	Sandy, mixed, thermic Typic Udifluvents
Larton	Loamy, siliceous, thermic Arenic Paleudalfs
Latanier	Clayey over loamy, mixed, thermic Vertic Hapludolls
Lightning	Fine, mixed, thermic Typic Ochraqualfs
Linker	Fine-loamy, siliceous, thermic Typic Hapludults
Mason	Fine-silty, mixed, thermic Typic Argiudolls
Muldrow	Fine, mixed, thermic Typic Argiaquolls
Norwood	Fine-silty, mixed [calcareous], thermic Typic Udifluvents
Okay	Fine-loamy, mixed, thermic Typic Argiudolls
Okemah	Fine, mixed, thermic Aquic Paleudolls
Oktaha	Fine-loamy, siliceous, thermic Typic Hapludults
Osage	Fine, montmorillonitic, thermic Vertic Haplaquolls
Parsons	Fine, mixed, thermic Mollic Albaqualfs
Roebuck	Fine, montmorillonitic, thermic Vertic Hapludolls
Roxana	Coarse-silty, mixed, nonacid, thermic Typic Udifluvents
Severn	Coarse-silty, mixed [calcareous], thermic Typic Udifluvents
Shermore	Fine-loamy, siliceous, thermic Typic Fragiudalfs
* Shidler	Loamy, mixed, thermic Lithic Haplustolls
Spiro	Fine-silty, siliceous, thermic Ultic Hapludalfs
Stigler	Fine, mixed, thermic Aquic Paleudalfs
Taloka	Fine, mixed, thermic Mollic Albaqualfs
Tullahassee	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents
Verdigris	Fine-silty, mixed, thermic Cumulic Hapludolls
Woodson	Fine, montmorillonitic, thermic Abruptic Argiaquolls

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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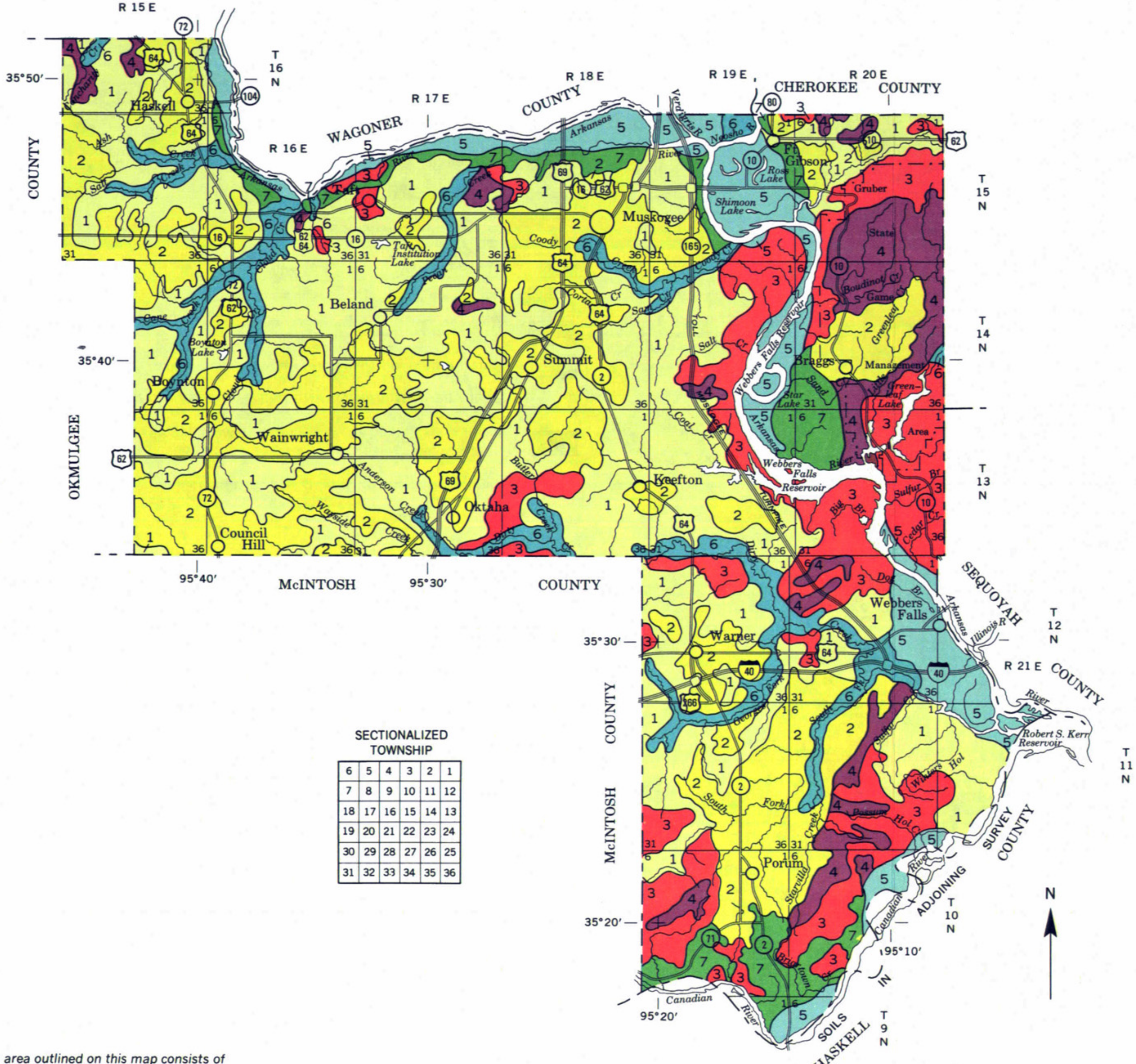


LEGEND

1	DENNIS-BATES-COWETA: Deep to shallow, nearly level to strongly sloping, moderately well drained to somewhat excessively drained soils that have a loamy surface layer and a loamy or clayey subsoil; on uplands
2	TALOKA-PARSONS-STIGLER: Deep, nearly level and very gently sloping, somewhat poorly drained and moderately well drained soils that have a loamy surface layer and a clayey subsoil; on uplands and terraces
3	ENDERS-HECTOR-LINKER: Deep to shallow, very gently sloping to very steep, well drained soils that have a loamy surface layer and a clayey or loamy subsoil; on uplands
4	OKTAHA-HECTOR: Moderately deep and shallow, very gently sloping and gently sloping, well drained soils that have a loamy surface layer and a loamy subsoil; on uplands
5	SEVERN-KIOMATIA-ROEBUCK: Deep, nearly level to moderately sloping, well drained or somewhat poorly drained soils that have a loamy, sandy, or clayey surface layer and loamy or sandy underlying layers or a clayey subsoil; on flood plains
6	VERDIGRIS-LIGHTNING: Deep, nearly level, moderately well drained and somewhat poorly drained soils that have a loamy surface layer and loamy underlying layers or a loamy and clayey subsoil; on flood plains
7	KAMIE-LARTON: Deep, nearly level to strongly sloping, well drained soils that have a loamy or sandy surface layer and a loamy subsoil; on high terraces

Compiled 1986

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
OKLAHOMA CONSERVATION COMMISSION
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

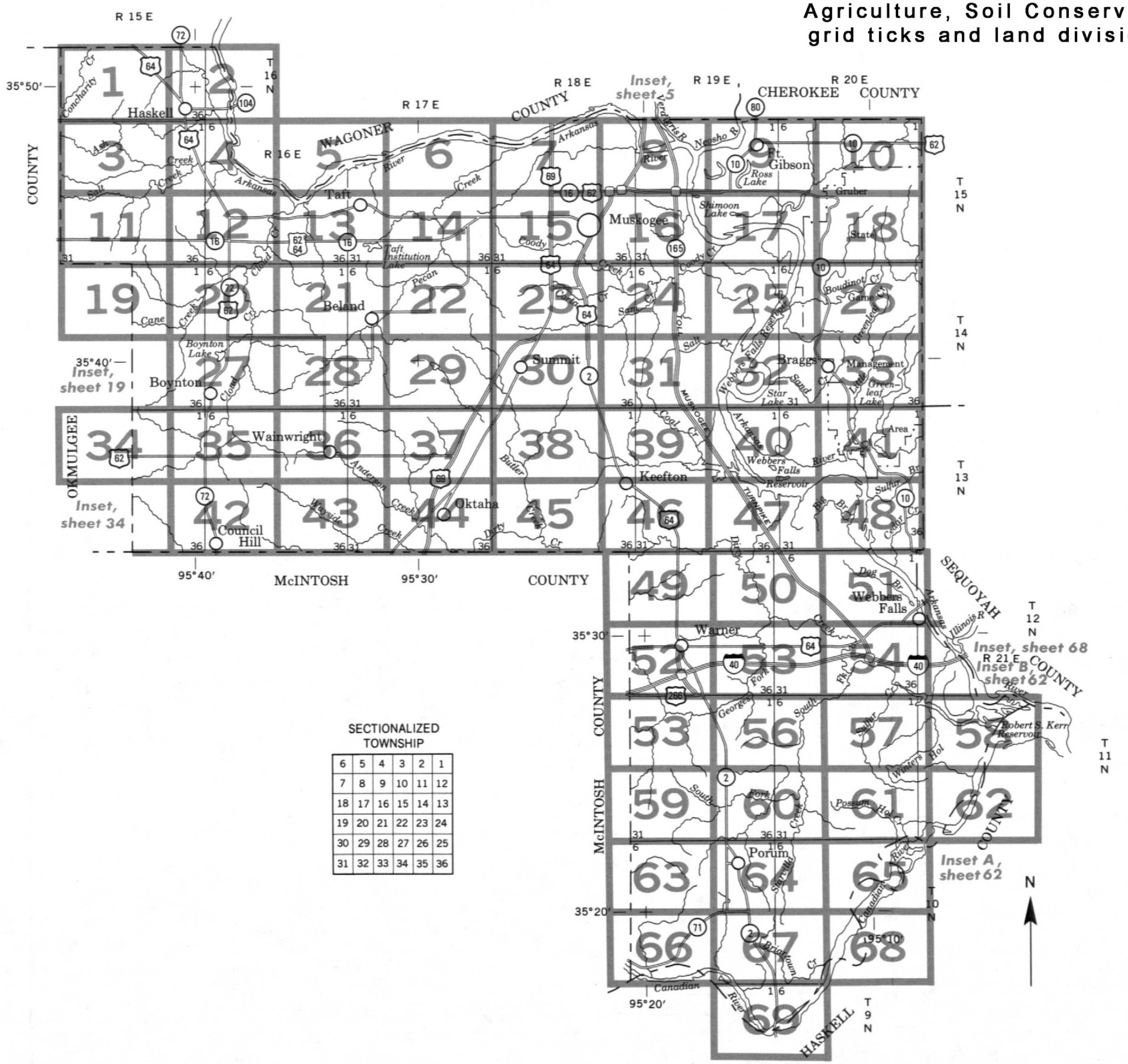
MUSKOGEE COUNTY, OKLAHOMA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

Original text from each individual map sheet read:
This map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

MUSKOGEE COUNTY, OKLAHOMA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

SOIL LEGEND

The legend is numeric. Soils without a slope designation in the name are those that occur on nearly level flood plains, soil associations, or miscellaneous areas.

SYMBOL	NAME
1	Barge silt loam, 3 to 30 percent slopes
2	Bates loam, 1 to 3 percent slopes
3	Bates loam, 3 to 5 percent slopes
4	Bates loam, 2 to 5 percent slopes, eroded
5	Bates-Coweta fine sandy loams, 1 to 3 percent slopes
6	Bates-Coweta fine sandy loams, 3 to 5 percent slopes
7	Caspiana silt loam, rarely flooded
8	Choska silt loam, rarely flooded
9	Choteau loam, 1 to 3 percent slopes
10	Coweta fine sandy loam, 5 to 12 percent slopes
11	Cupco silt loam, occasionally flooded
12	Dennis silt loam, 1 to 3 percent slopes
13	Dennis silt loam, 3 to 5 percent slopes
14	Dennis silt loam, 2 to 5 percent slopes, eroded
15	Dennis silt loam, 2 to 6 percent slopes, gullied
16	Dennis-Urban land complex, 0 to 3 percent slopes
17	Dennis-Verdigris complex, 0 to 12 percent slopes
18	Enders-Linker-Hector association, moderately steep
19	Endsaw-Hector association, steep
20	Eram-Coweta-Rock outcrop association, strongly sloping
21	Garton silt loam, rarely flooded
22	Glenpool fine sand, 0 to 3 percent slopes
23	Glenpool fine sand, 3 to 12 percent slopes
24	Kamie fine sandy loam, 1 to 3 percent slopes
25	Kamie fine sandy loam, 3 to 5 percent slopes
26	Kamie fine sandy loam, 2 to 8 percent slopes, gullied
27	Kanima shaly silty clay loam, 3 to 30 percent slopes
28	Keo very fine sandy loam, rarely flooded
29	Kiomatia loamy fine sand, frequently flooded
30	Kiomatia fine sandy loam, rarely flooded
31	Kiomatia fine sandy loam, frequently flooded
32	Larton loamy fine sand, 0 to 3 percent slopes
33	Larton loamy fine sand, 3 to 8 percent slopes
34	Larton loamy fine sand, 3 to 12 percent slopes, gullied
35	Latanier silty clay loam, rarely flooded
36	Lightning silt loam, occasionally flooded
37	Linker fine sandy loam, 1 to 3 percent slopes
38	Linker fine sandy loam, 3 to 5 percent slopes
39	Mason silt loam, rarely flooded, 0 to 1 percent slopes
40	Mason silt loam, rarely flooded, 1 to 3 percent slopes
41	Muldrow silty clay loam, rarely flooded
42	Norwood silt loam, rarely flooded
43	Oil-waste land
44	Okay very fine sandy loam, 0 to 1 percent slopes
45	Okay very fine sandy loam, 1 to 3 percent slopes
46	Okemah silt loam, 0 to 1 percent slopes
47	Oktaha fine sandy loam, 1 to 3 percent slopes
48	Oktaha fine sandy loam, 3 to 5 percent slopes
49	Oktaha fine sandy loam, 2 to 5 percent slopes, eroded
50	Oktaha-Hector fine sandy loams, 1 to 5 percent slopes
51	Osage silty clay loam, rarely flooded
52	Parsons silt loam, 0 to 1 percent slopes
53	Parsons silt loam, 1 to 3 percent slopes
54	Parsons silt loam, 1 to 3 percent slopes, eroded
55	Parsons-Carytown silt loams, 0 to 1 percent slopes
56	Pits
57	Roebuck clay, rarely flooded
58	Roebuck clay, occasionally flooded
59	Roebuck clay, frequently flooded
60	Roxana very fine sandy loam, rarely flooded, 0 to 1 percent slopes
61	Roxana very fine sandy loam, rarely flooded, 1 to 3 percent slopes
62	Severn very fine sandy loam, rarely flooded, 0 to 1 percent slopes
63	Severn very fine sandy loam, rarely flooded, 2 to 6 percent slopes
64	Shermore loam, 3 to 5 percent slopes
65	Shidler-Rock outcrop complex, 5 to 30 percent slopes
66	Spiro silt loam, 1 to 3 percent slopes
67	Stigler silt loam, 0 to 1 percent slopes
68	Stigler silt loam, 1 to 3 percent slopes
69	Stigler-Urban land complex, 0 to 3 percent slopes
70	Taloka silt loam, 0 to 1 percent slopes
71	Taloka silt loam, 1 to 3 percent slopes
72	Taloka-Urban land complex, 0 to 3 percent slopes
73	Tullahassee loamy fine sand, frequently flooded
74	Urban land
75	Verdigris silt loam, rarely flooded
76	Verdigris silt loam, occasionally flooded
77	Verdigris silt loam, frequently flooded
78	Woodson silty clay loam, 0 to 1 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Swift Airport

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 31, 60

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

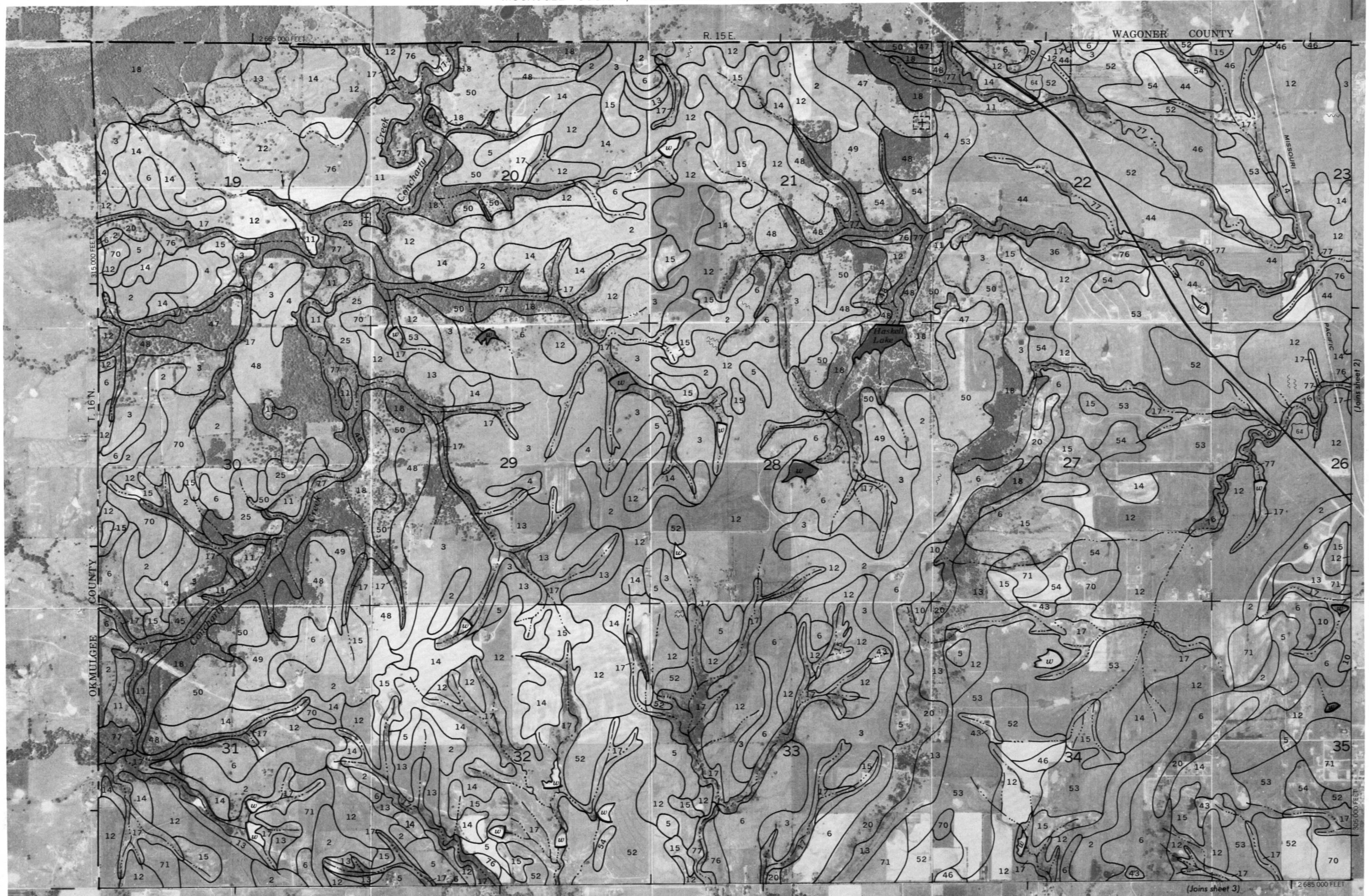
DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

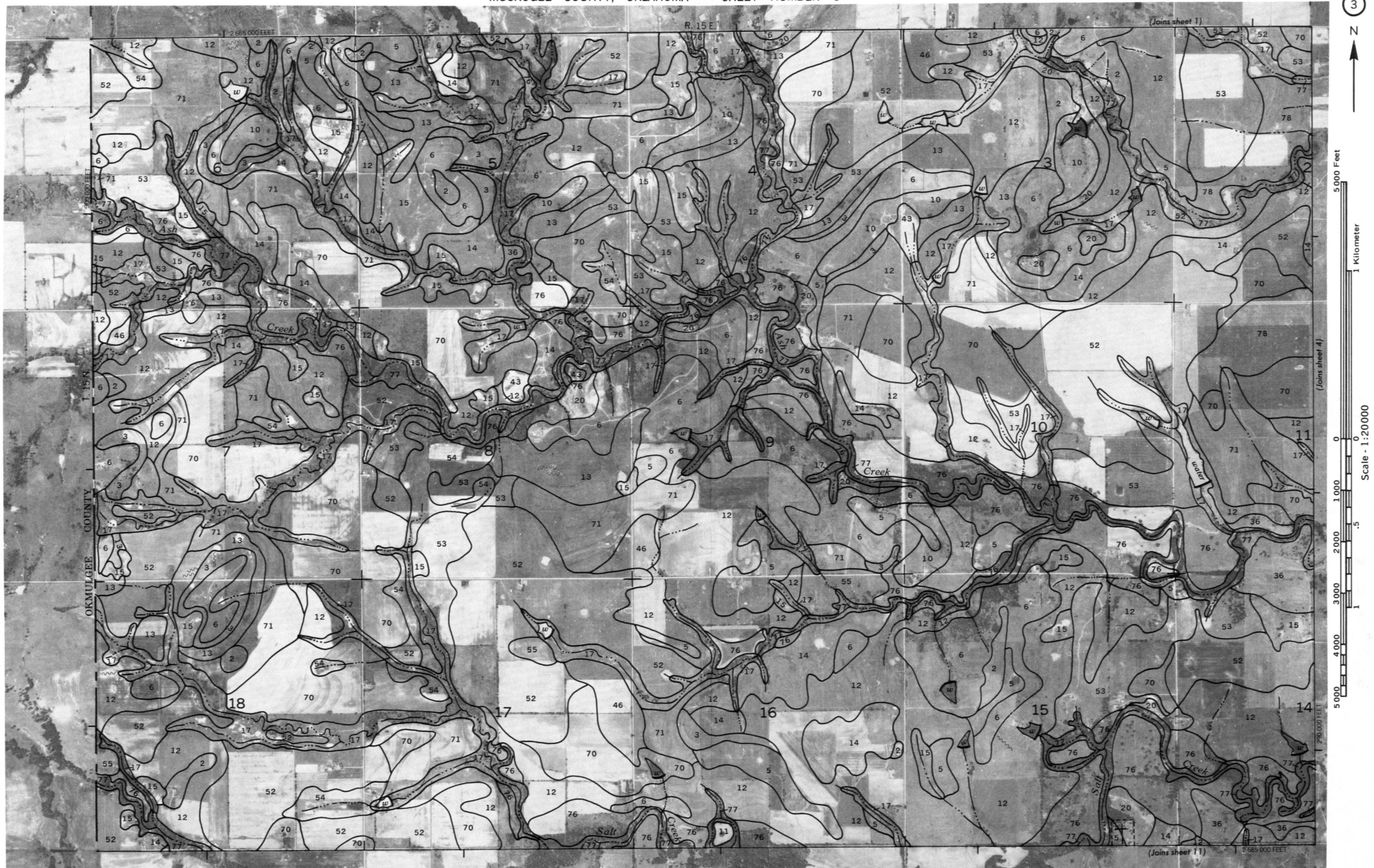
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 1




N
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5 000
.5
1
WAGONER COUNTY
R. 15 E.
R. 16 E.
2 705 000 FEET
320 000 FEET
T. 16 N.
ARKANSAS RIVER
WAGONER COUNTY BOUNDARY
INDEFINITE
HASKELL
MISSOURI PACIFIC
SEWAGE DISPOSAL PONDS
water
(Joins sheet 1)
(Joins sheet 4)
2 690 000 FEET
305 000 FEET

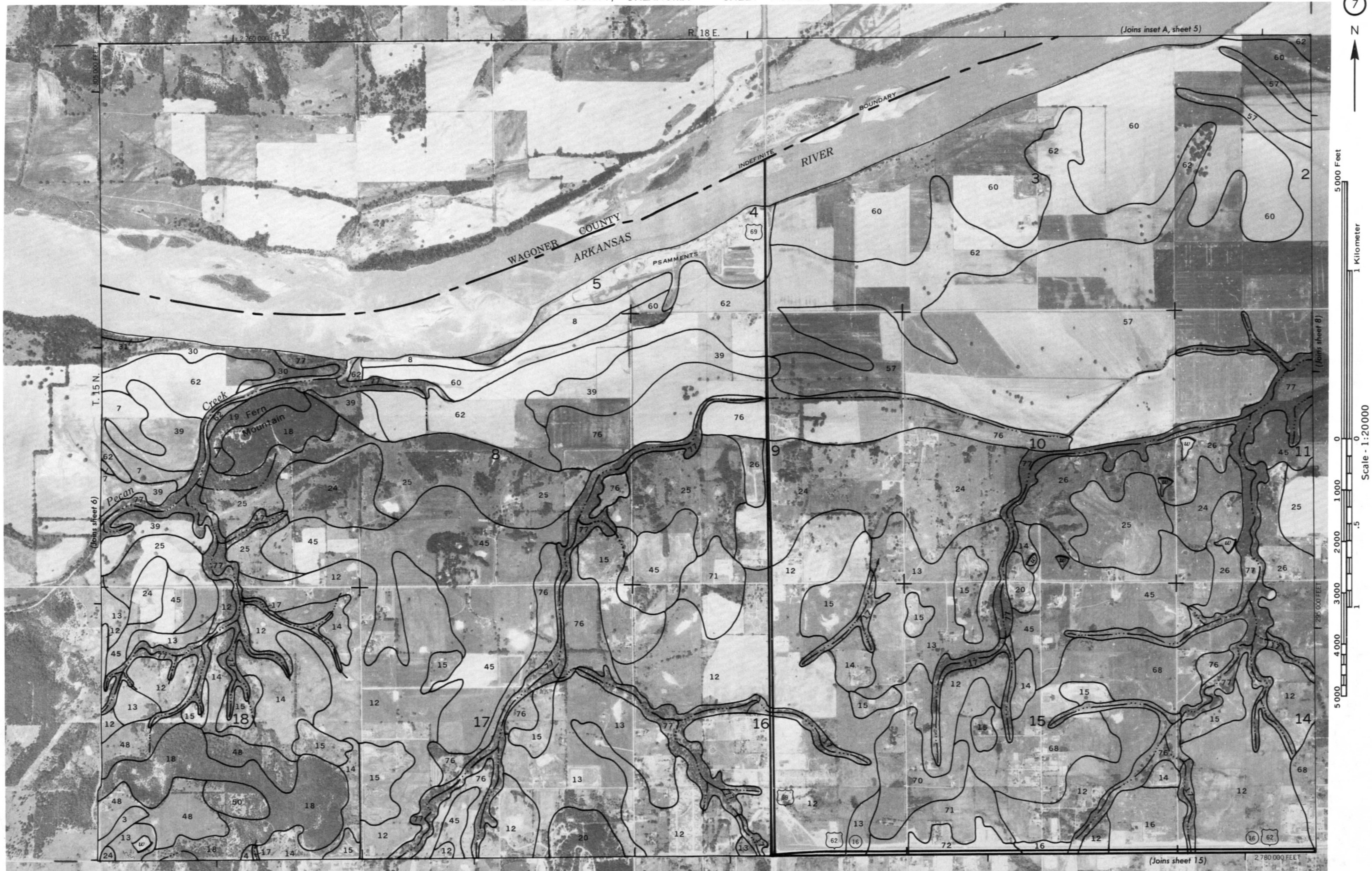

3
N
R. 15 E.
T. 15 N.
(Joins sheet 1)
(Joins sheet 4)
(Joins sheet 11)
OKMULGEE COUNTY
2 665 000 FEET
2 685 000 FEET
Ash Creek
Salt Creek
5 000 Feet
1 Kilometer
Scale - 1:20000

MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 4

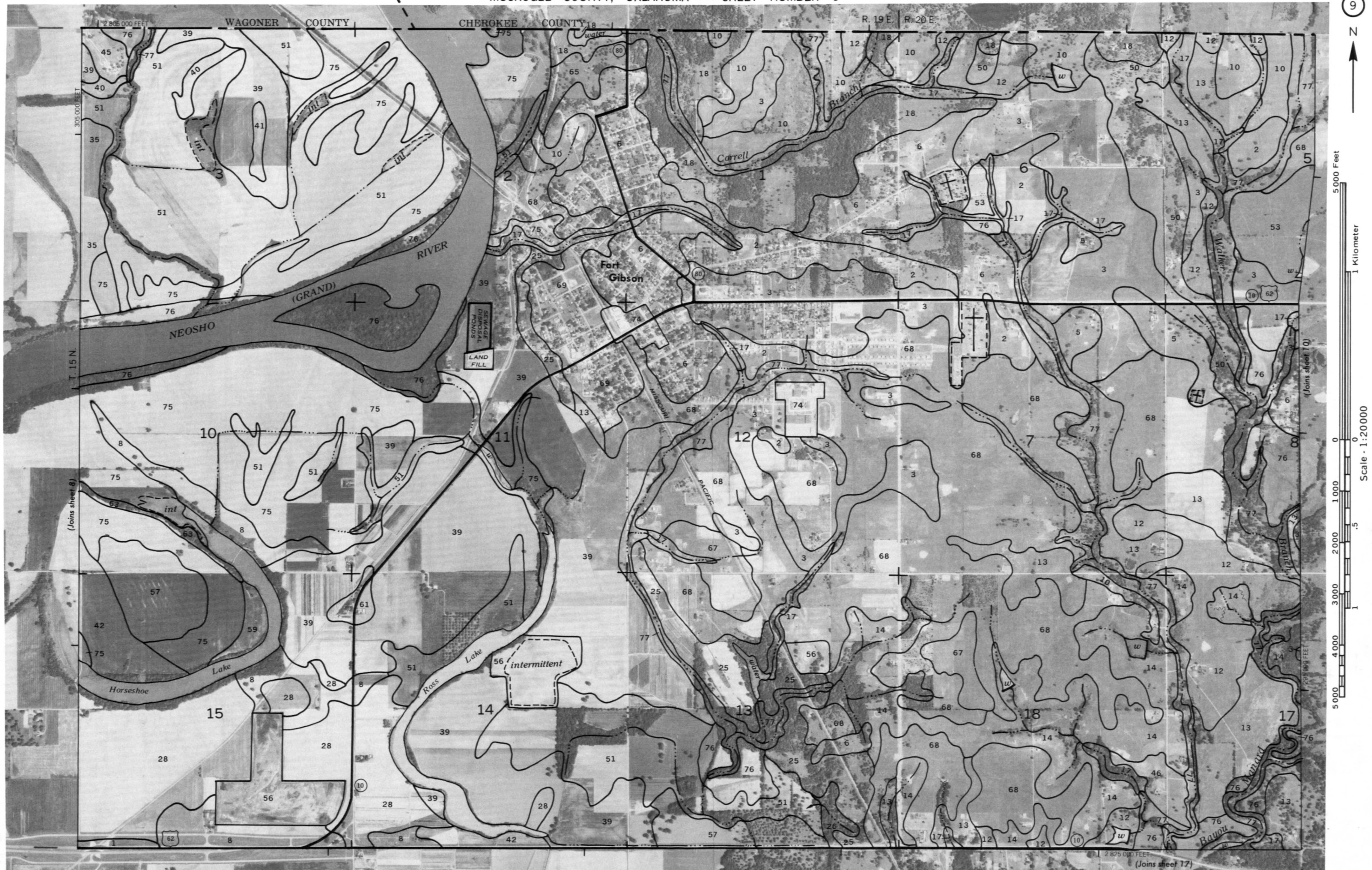
MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 5


N
5 000 Feet
1 Kilometer
Scale 1:20000
R. 17 E.
2 755 000 FEET
305 000 FEET
WAGONER COUNTY
ARKANSAS RIVER
INDEFINITE BOUNDARY
Pecan Creek
T. 15 N.
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 14)
2 735 000 FEET
290 000 FEET

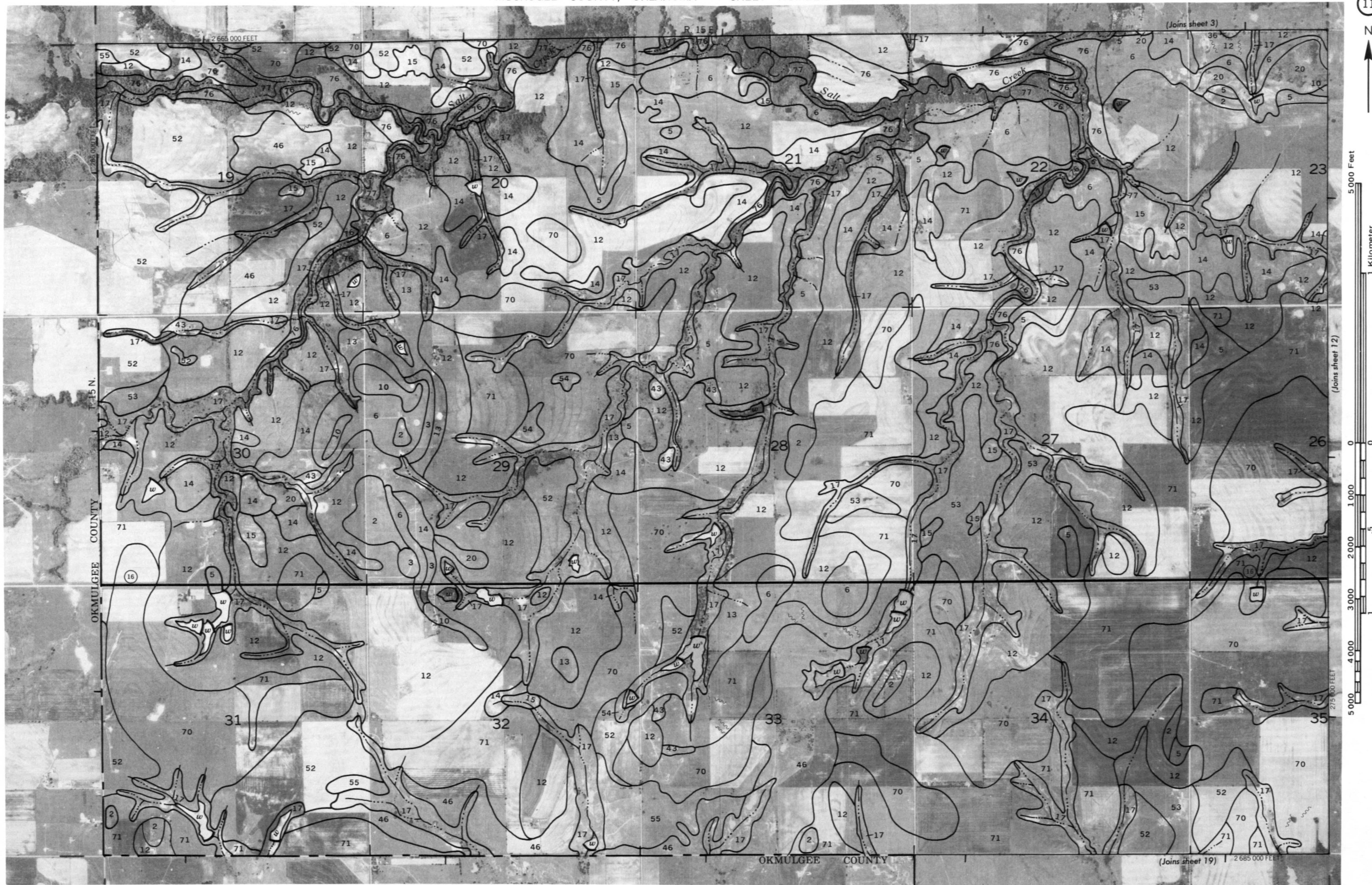
MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 7



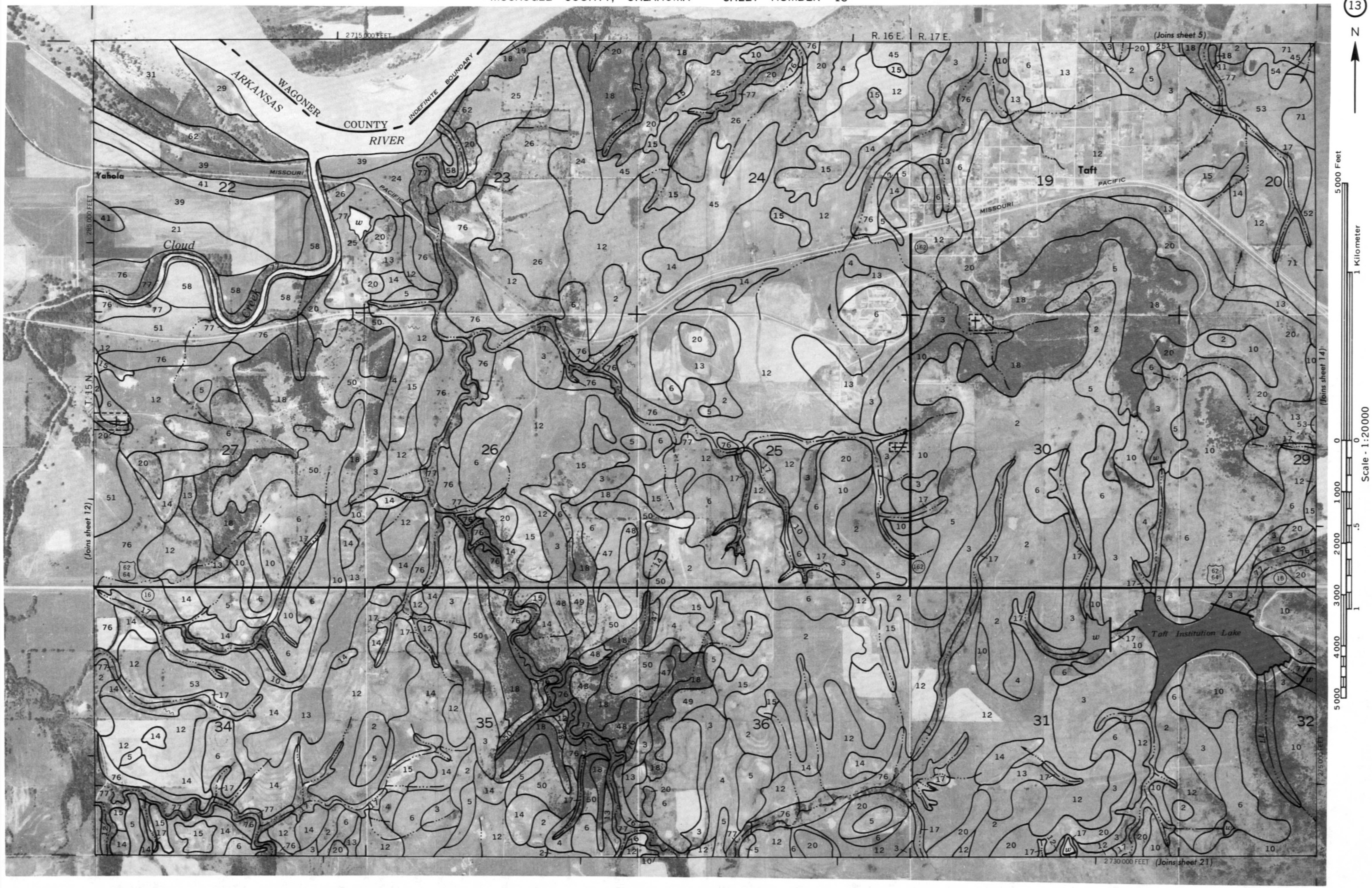

8
N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins inset B, sheet 5)
R. 18 E. | R. 19 E.
WAGONER COUNTY
2 800 000 FEET
305 000 FEET
Wybark
water
VERDIGRIS RIVER
RIVER
ARKANSAS
NEOSHO (GRAND) RIVER
T. 15 N.
(Joins sheet 7)
(Joins sheet 9)
TEXAS
KANSAS
MISSOURI
MUSKOGEE TURNPIKE (TOLL)
Hyde Park
WEBBERS FALLS RESERVOIR
Horseshoe Lake
water
295 000 FEET
MUSKOGEE
(county seat)
(Joins sheet 16)
2 785 000 FEET

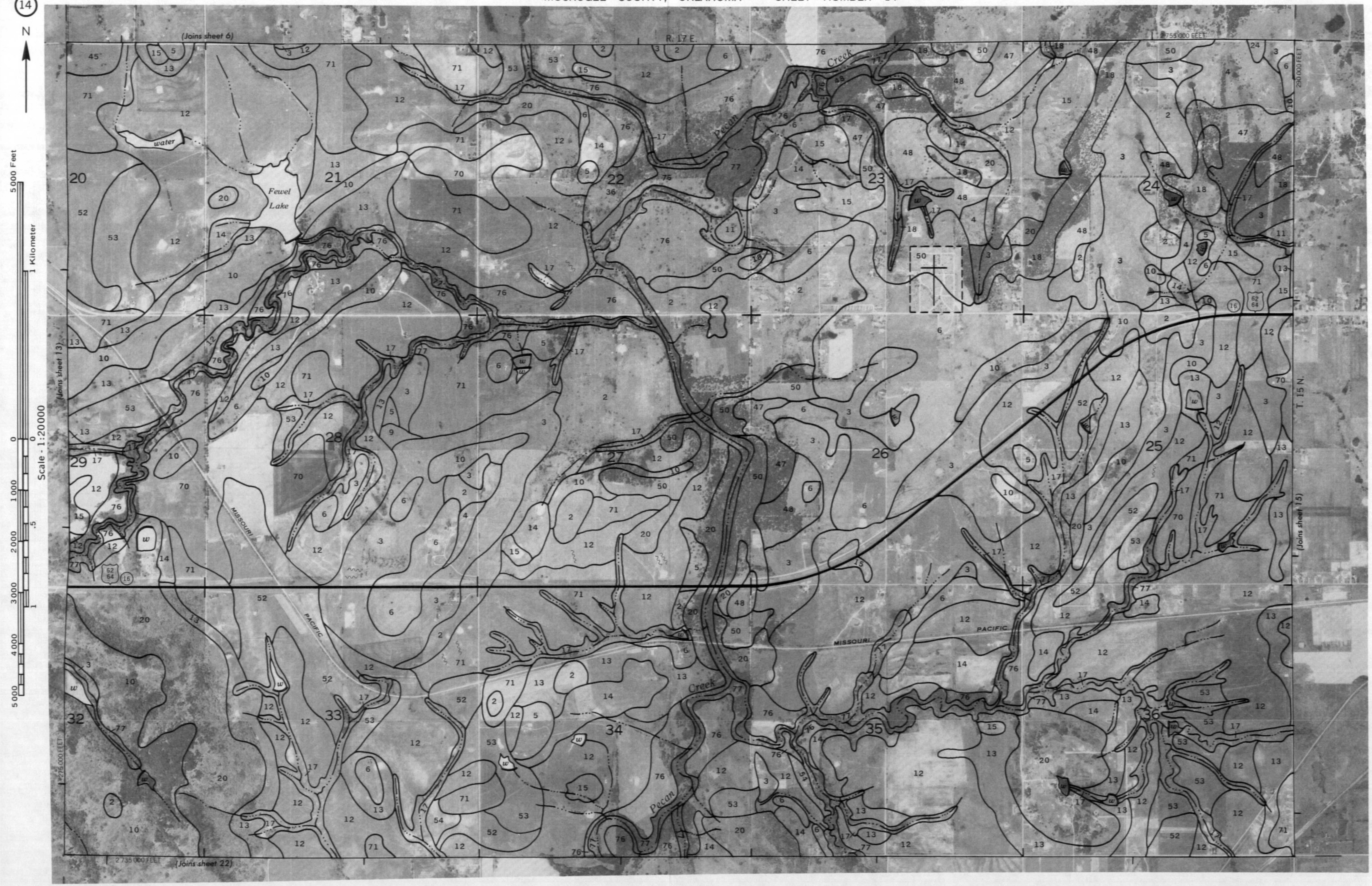

9
WAGONER COUNTY
CHEROKEE COUNTY
R. 19 E.
R. 20 E.
2 805 000 FEET
305 000 FEET
2 825 000 FEET
T. 15 N.
NEOSHO (GRAND) RIVER
Fort Gibson
SEWAGE DISPOSAL PONDS
LAND FILL
MISSOURI PACIFIC
Correll Branch
Walker Branch
Horseshoe Lake
Ross Lake
intermittent
water
Manard Bayou
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 17)
N
5 000 Feet
1 Kilometer
Scale - 1:20000

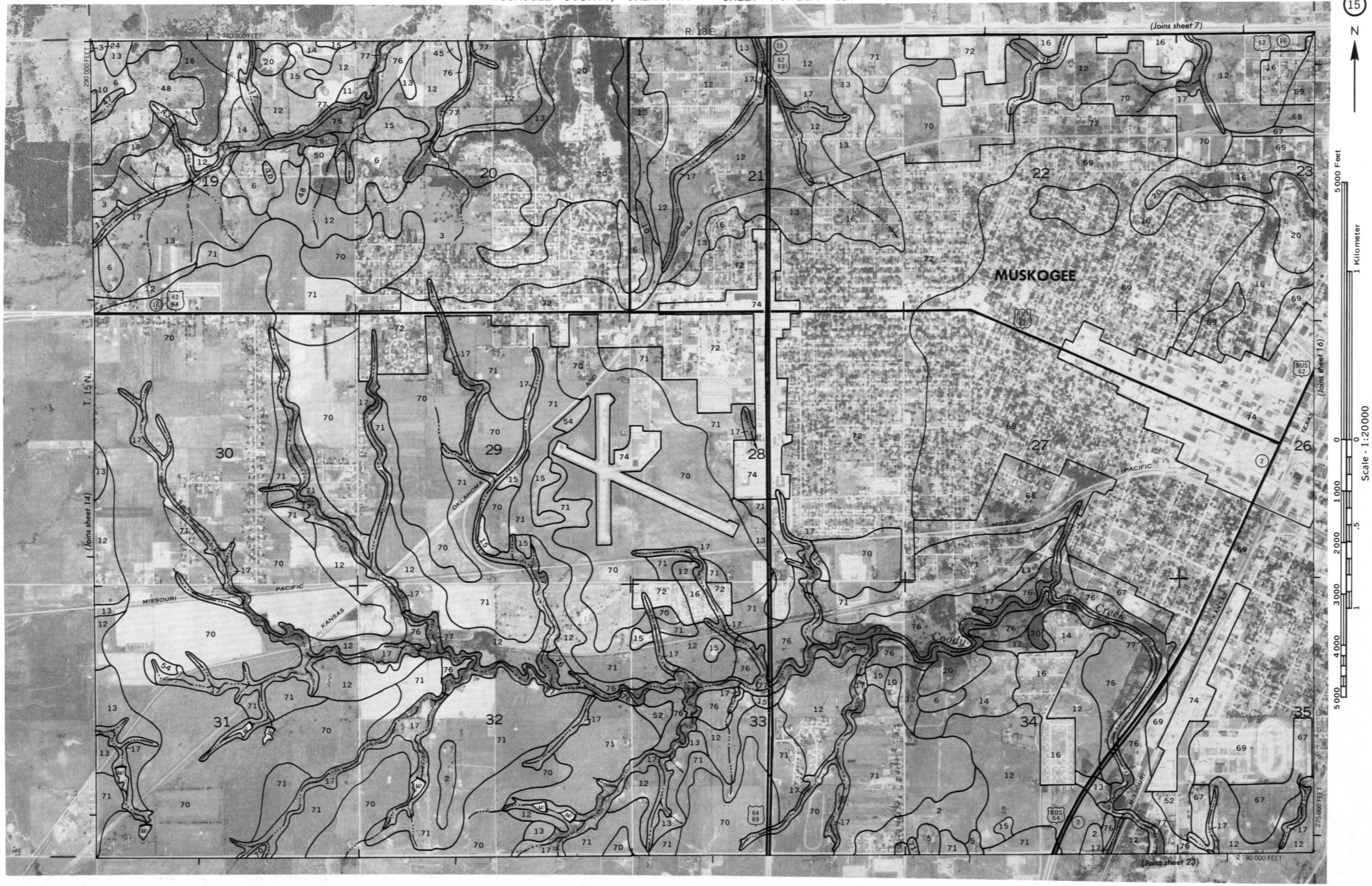

N
5000 Feet
1 Kilometer
Scale - 1:20000
CHEROKEE COUNTY
R. 20 E.
T. 15 N.
2 850 000 FEET
2 830 000 FEET
(Joins sheet 9)
(Joins sheet 18)
Branch
Fourmile Bayou
Manard
Manard Bayou
Hicks Branch
Red Berry Mountain
CHEROKEE COUNTY


11
N
(Joins sheet 3)
(Joins sheet 12)
(Joins sheet 19)
R. 15 E.
T. 15 N.
2 665 000 FEET
2 685 000 FEET
OKMULGEE COUNTY
Salt Creek
5000 Feet
1 Kilometer
Scale - 1:20000
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

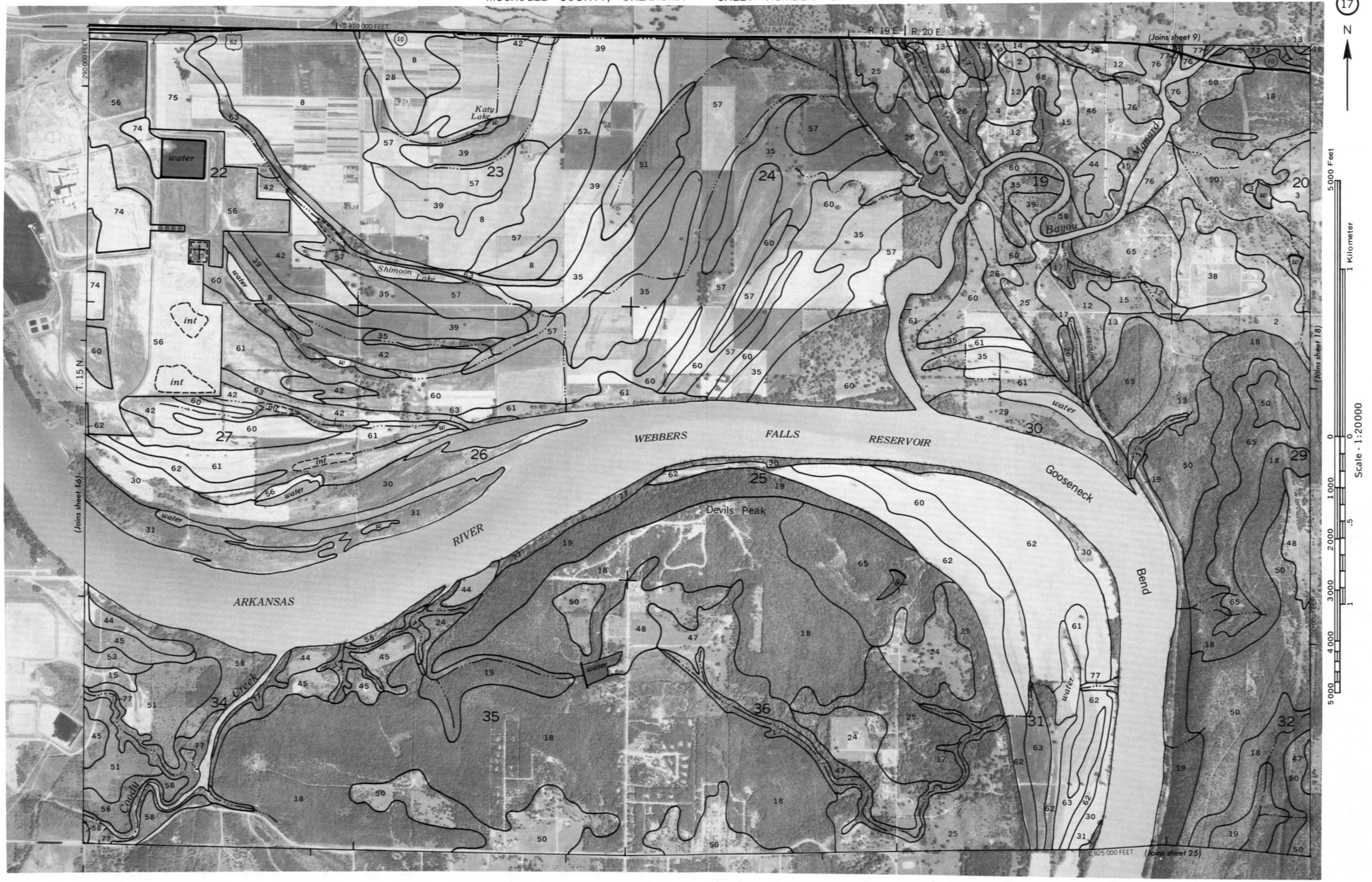

N
(Joins sheet 4)
R. 15 E.
R. 16 E.
2 710 000 FEET
MISSOURI PACIFIC
Yahola
Jamesville
water
Cloud Creek
T. 15 N.
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 20)
2 690 000 FEET
5000 Feet
1 Kilometer
Scale - 1:20000
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33


WAGONER COUNTY
ARKANSAS RIVER
INDEFINITE BOUNDARY
Yahola
MISSOURI PACIFIC
Cloud Creek
Taft
Taft Institution Lake
R. 16 E.
R. 17 E.
T. 15 N.
(Joins sheet 5)
(Joins sheet 14)
(Joins sheet 12)
(Joins sheet 21)
2 715 000 FEET
2 730 000 FEET
285 000 FEET
N
5000 Feet
1 Kilometer
Scale - 1:20000

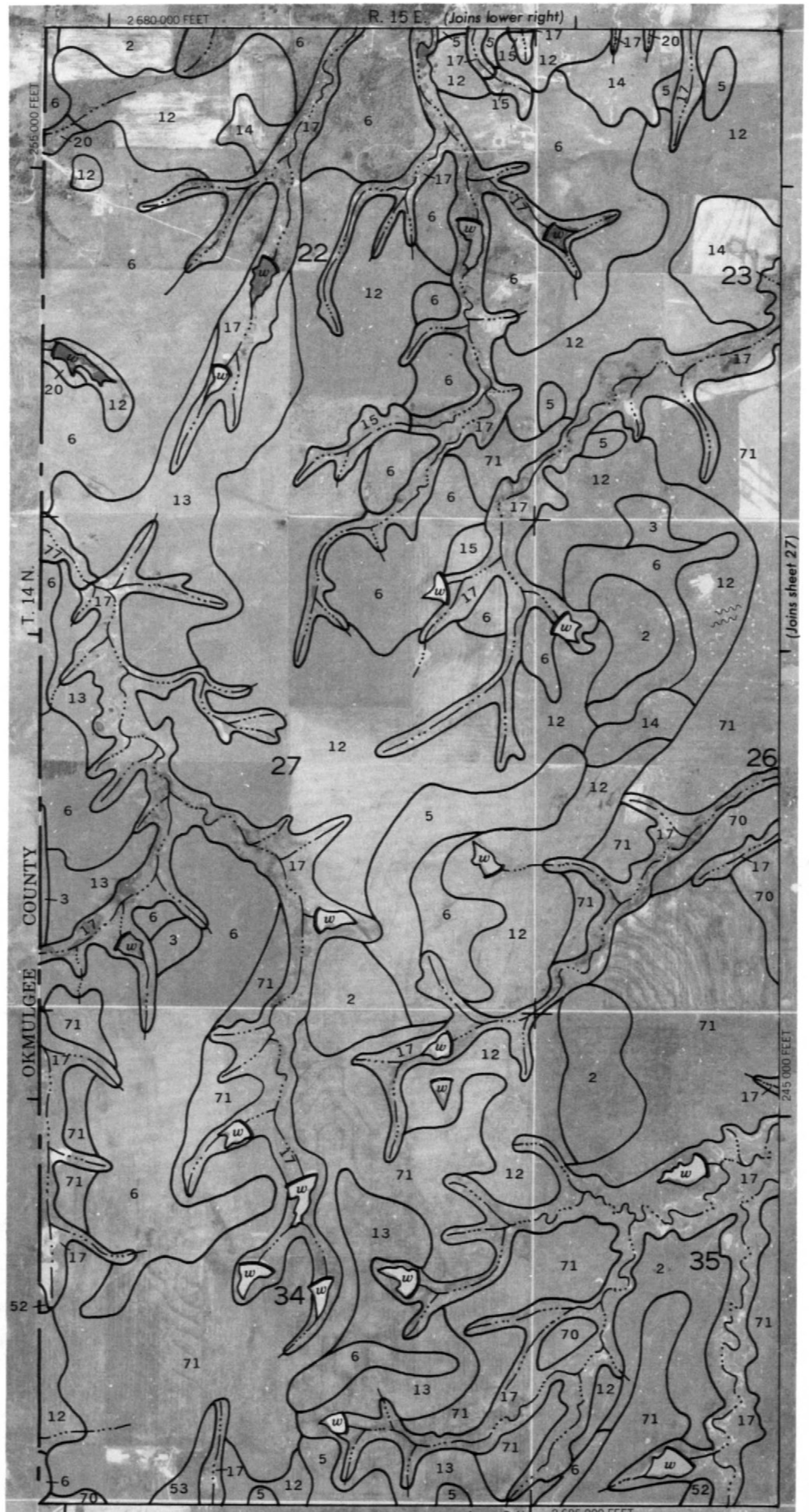

N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 6)
R. 17 E.
2 755 000 FEET
290 000 FEET
water
Fewel Lake
Pecan Creek
MISSOURI PACIFIC
(Joins sheet 13)
(Joins sheet 15)
T. 15 N.
275 000 FEET
2 735 000 FEET
(Joins sheet 22)

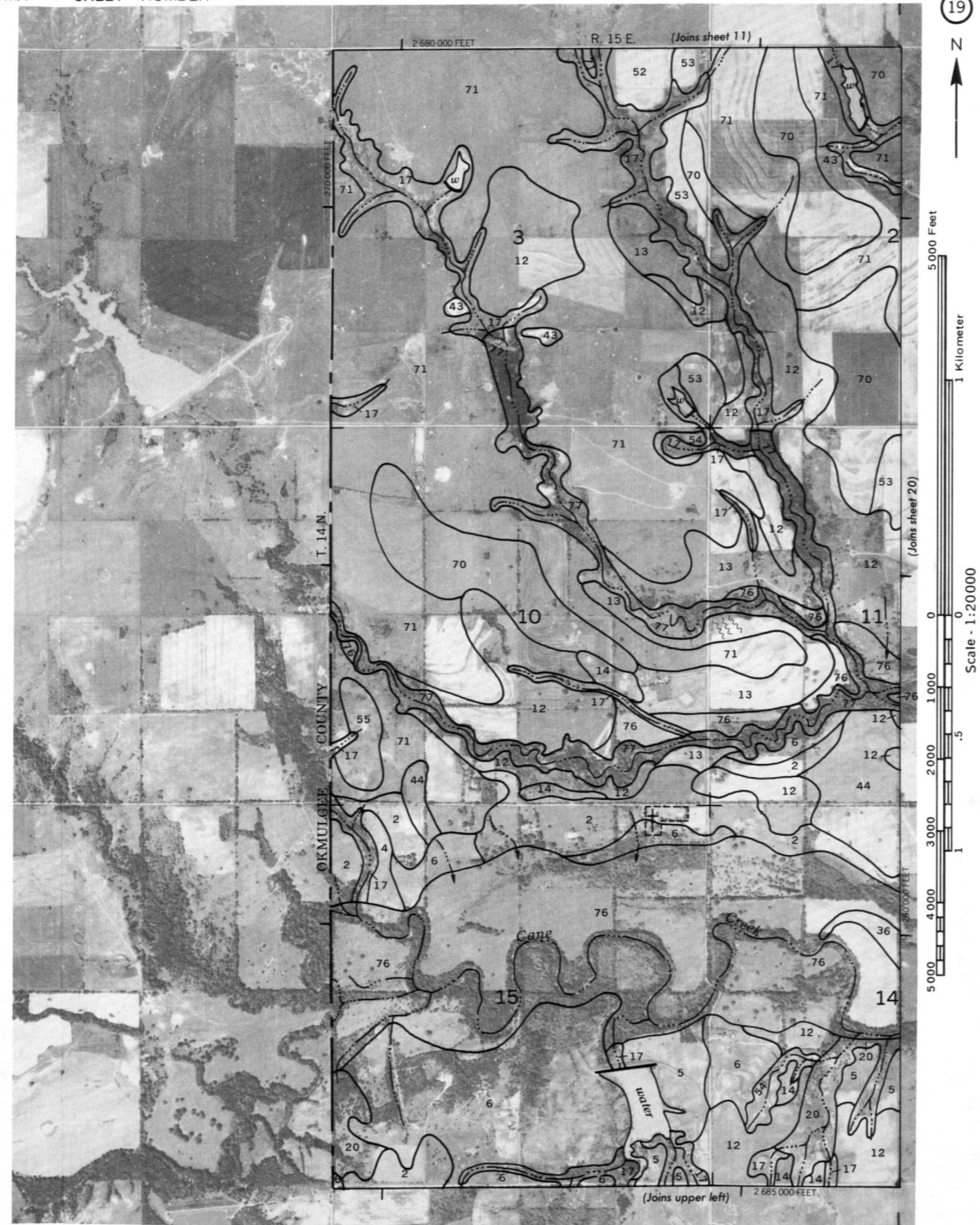

15
N
(Joins sheet 7)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 23)
R. 18 E.
T. 15 N.
2 760 000 FEET
2 780 000 FEET
290 000 FEET
275 000 FEET
MUSKOGEE
Coody
Creek
MISSOURI
PACIFIC
KANSAS
TEXAS
OKLAHOMA
GULF
AND
5000 Feet
1 Kilometer
Scale - 1:20000

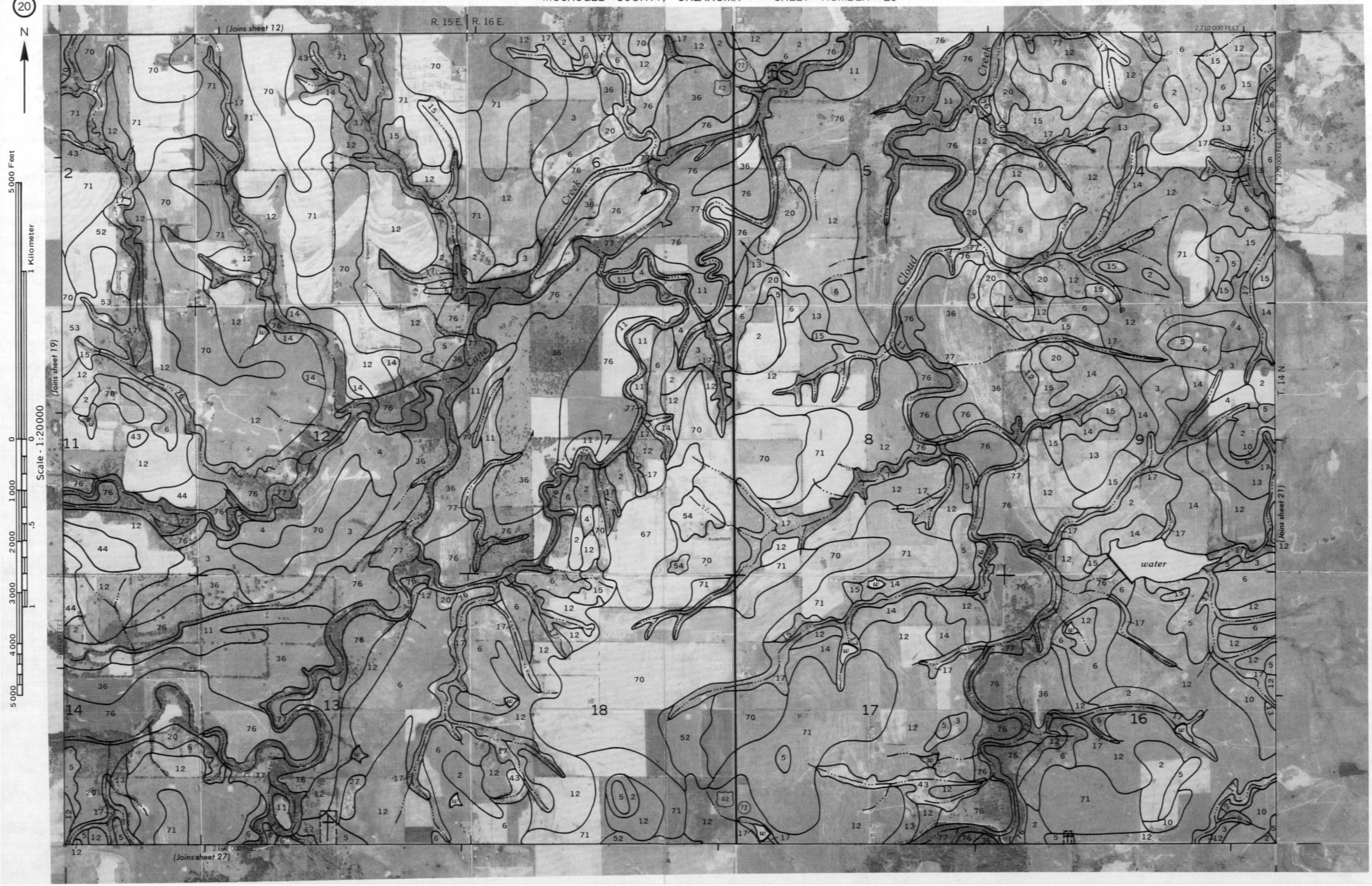

16
N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 8)
R. 18 E. | R. 19 E.
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 24)
T. 15 N.
MUSKOGEE
(county seat)
WEBBERS FALLS RESERVOIR
ARKANSAS RIVER
MUSKOGEE TURNPIKE (TOLL)
MISSOURI PACIFIC
water
2 805 000 FEET
2 785 000 FEET


17
N
(Joins sheet 9)
R. 19 E. | R. 20 E.
2 810 000 FEET
290 000 FEET
T. 15 N.
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 25)
2 825 000 FEET
Katy Lake
Shimoon Lake
Bayou
Manard
Missouri Pacific
WEBBERS FALLS RESERVOIR
ARKANSAS RIVER
Gooseneck Bend
Devils Peak
Coody Creek
water
int
5 000 Feet
1 Kilometer
Scale - 1:20000


18
N
(Joins sheet 10)
R. 20 E.
Sleeper
Hollow
Braggs Mountain
(Joins sheet 17)
(Joins sheet 26)
West Spaniard Creek
T. 15 N.
CHEROKEE COUNTY
5000 Feet
1 Kilometer
Scale - 1:20000
2 830 000 FEET
2 850 000 FEET
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

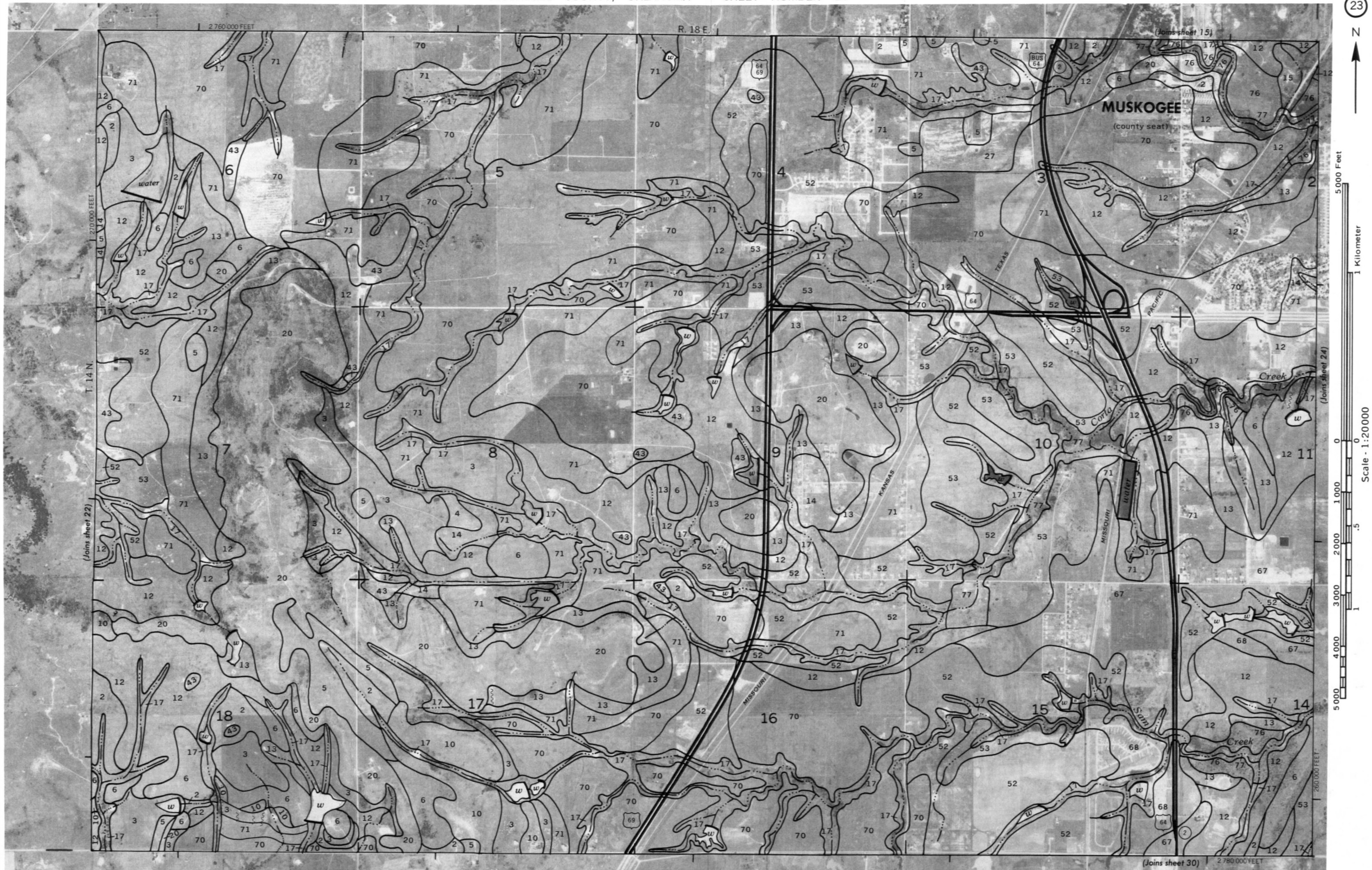

R. 15 E.
(Joins lower right)
2 680 000 FEET
(Joins sheet 27)
T. 14 N.
OKMULGEE COUNTY
(Joins sheet 34)
2 685 000 FEET

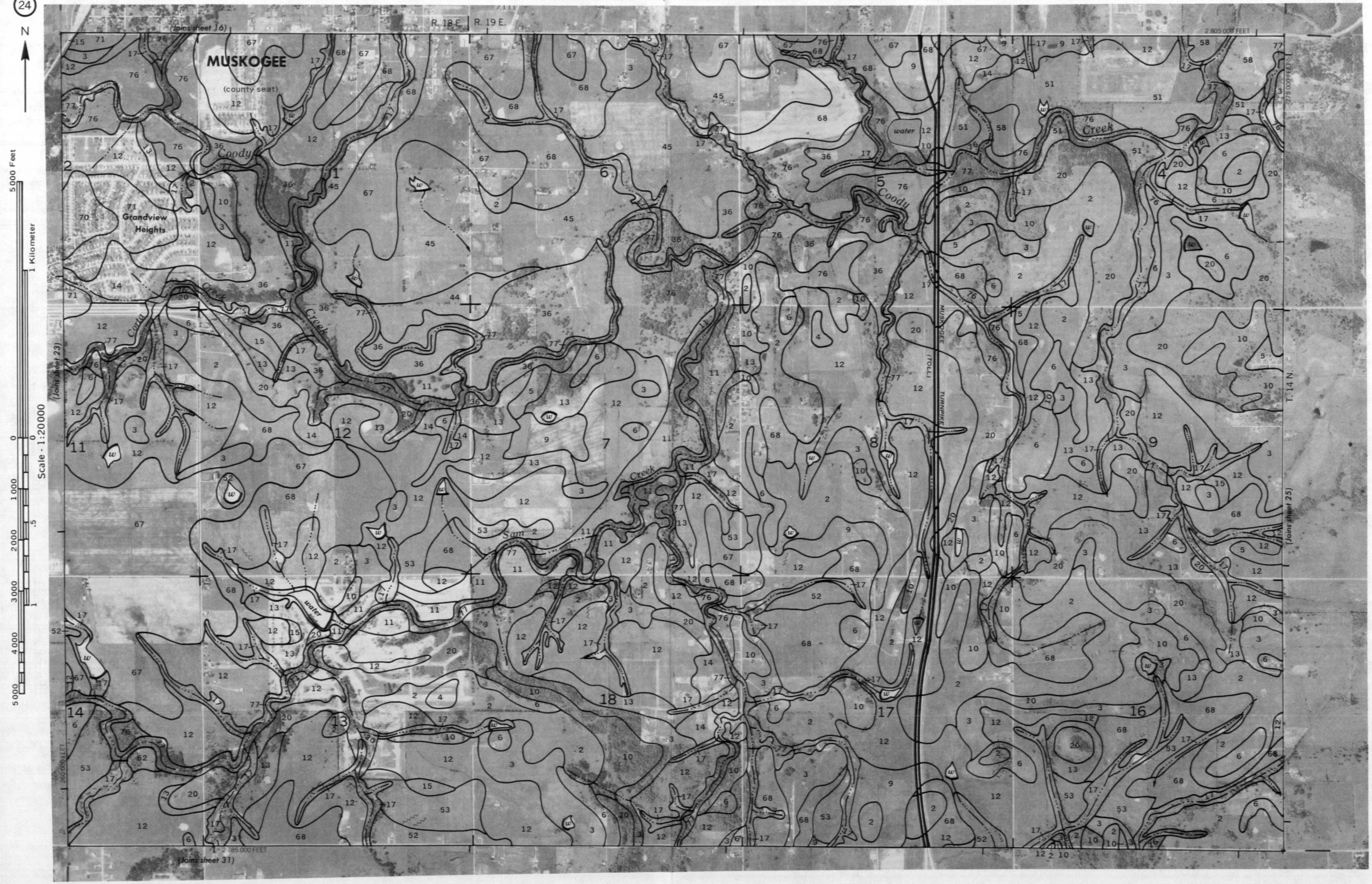

R. 15 E.
(Joins sheet 11)
2 680 000 FEET
(Joins sheet 20)
T. 14 N.
OKMULGEE COUNTY
Cane
Creek
water
(Joins upper left)
2 685 000 FEET
N
5000 Feet
1 Kilometer
Scale - 1:20000


20
N
(Joins sheet 12)
R. 15 E.
R. 16 E.
2 710 000 FEET
T. 14 N.
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
Cane Creek
Cloud Creek
water
5000 Feet
1 Kilometer
Scale - 1:20000

MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 21

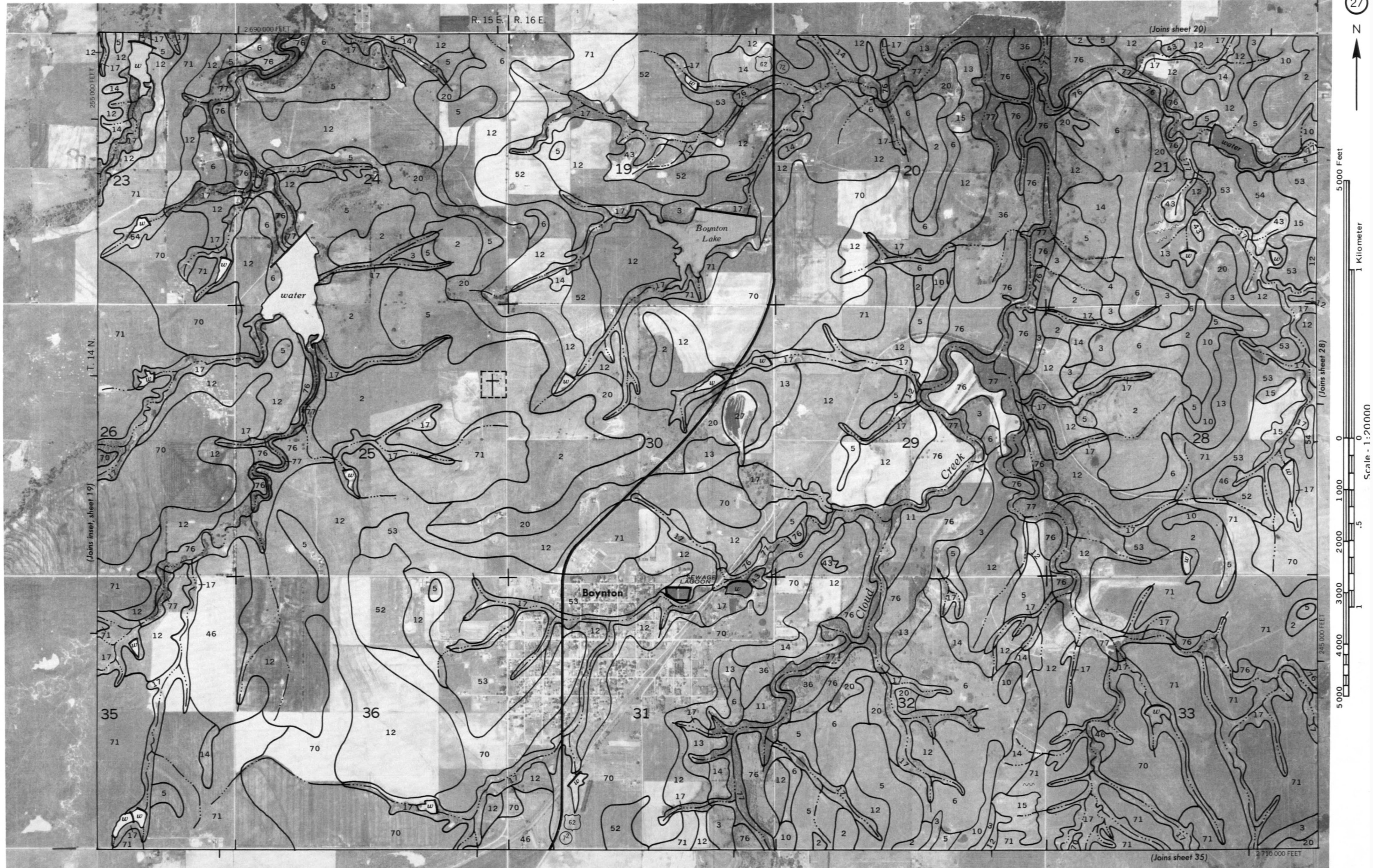

N
5 000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 14)
R. 17 E.
2 755 000 FEET
Hofschulte Hill
Baucum Hill
Crekola
Creek
Pecan
GULF
AND
OKLAHOMA
KANSAS
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 29)
T. 14 N.
270 000 FEET
260 000 FEET
2 735 000 FEET


23
N
(Joins sheet 15)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
2 760 000 FEET
2 780 000 FEET
270 000 FEET
260 000 FEET
R. 18 E.
T. 14 N.
MUSKOGEE
(county seat)
water
Creek
Coria
Sam
MISSOURI
KANSAS
TEXAS
PACIFIC
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1

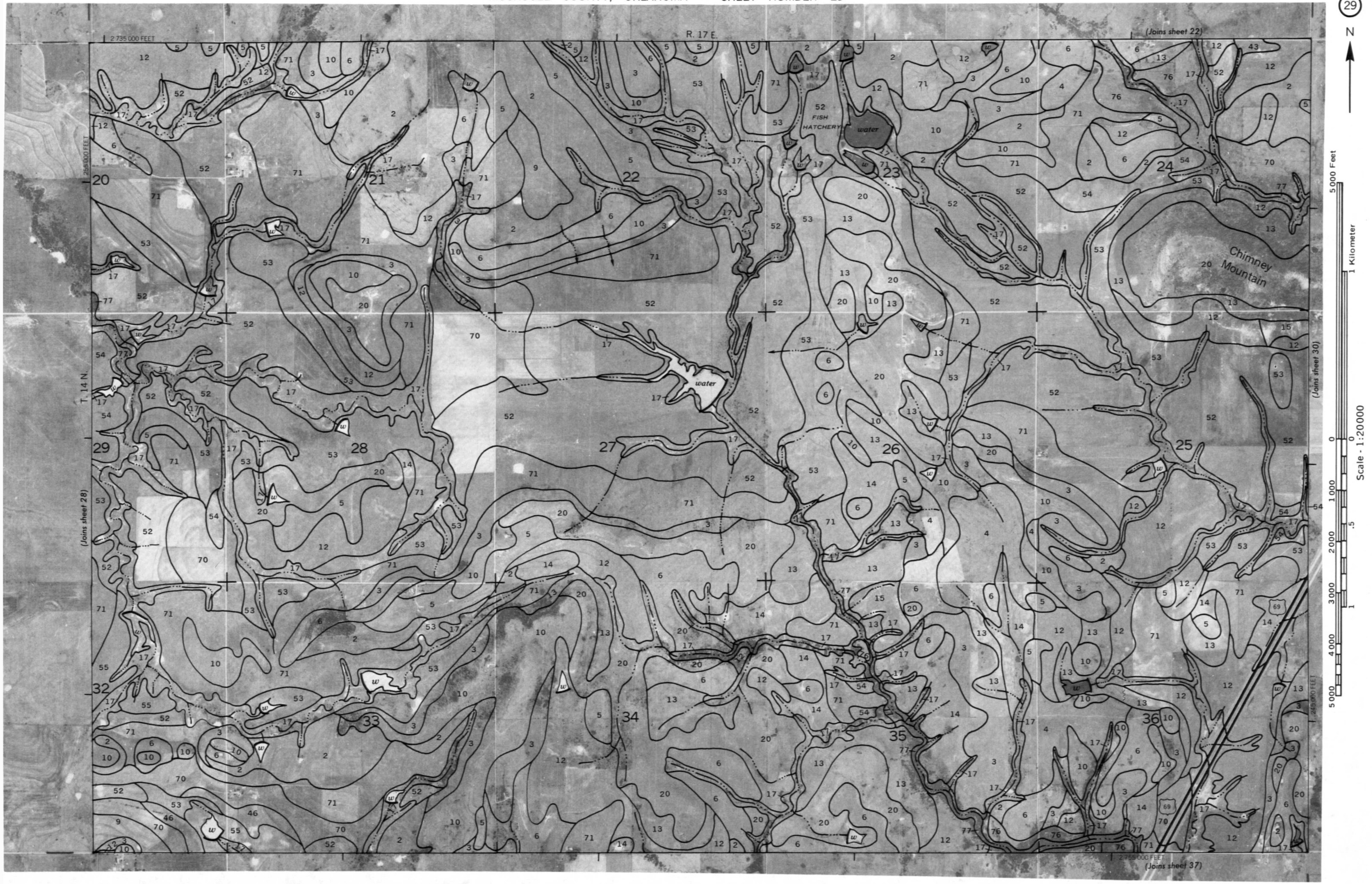

24
N
MUSKOGEE
(county seat)
Grandview Heights
Coody Creek
Cotta Creek
Sam Creek
water
MUSKOGEE (TOLL) TURNPIKE
R. 18 E.
R. 19 E.
T. 14 N.
(Joins sheet 16)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
2 805 000 FEET
2 785 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000


25
N
(Joins sheet 17)
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 32)
R. 19 E. | R. 20 E.
T. 14 N.
2 810 000 FEET
WEBBERS FALLS RESERVOIR
ARKANSAS RIVER
Boudinot Creek
Joe Branch
water
5000 Feet
1 Kilometer
Scale - 1:20000


N
(Joins sheet 18)
R. 20 E.
Pumpkin Center Pond
WPA Pond
Boudinot Creek
(Joins sheet 25)
(Joins sheet 33)
T. 14 N.
CHEROKEE COUNTY
5 000 Feet
1 Kilometer
Scale - 1:20000

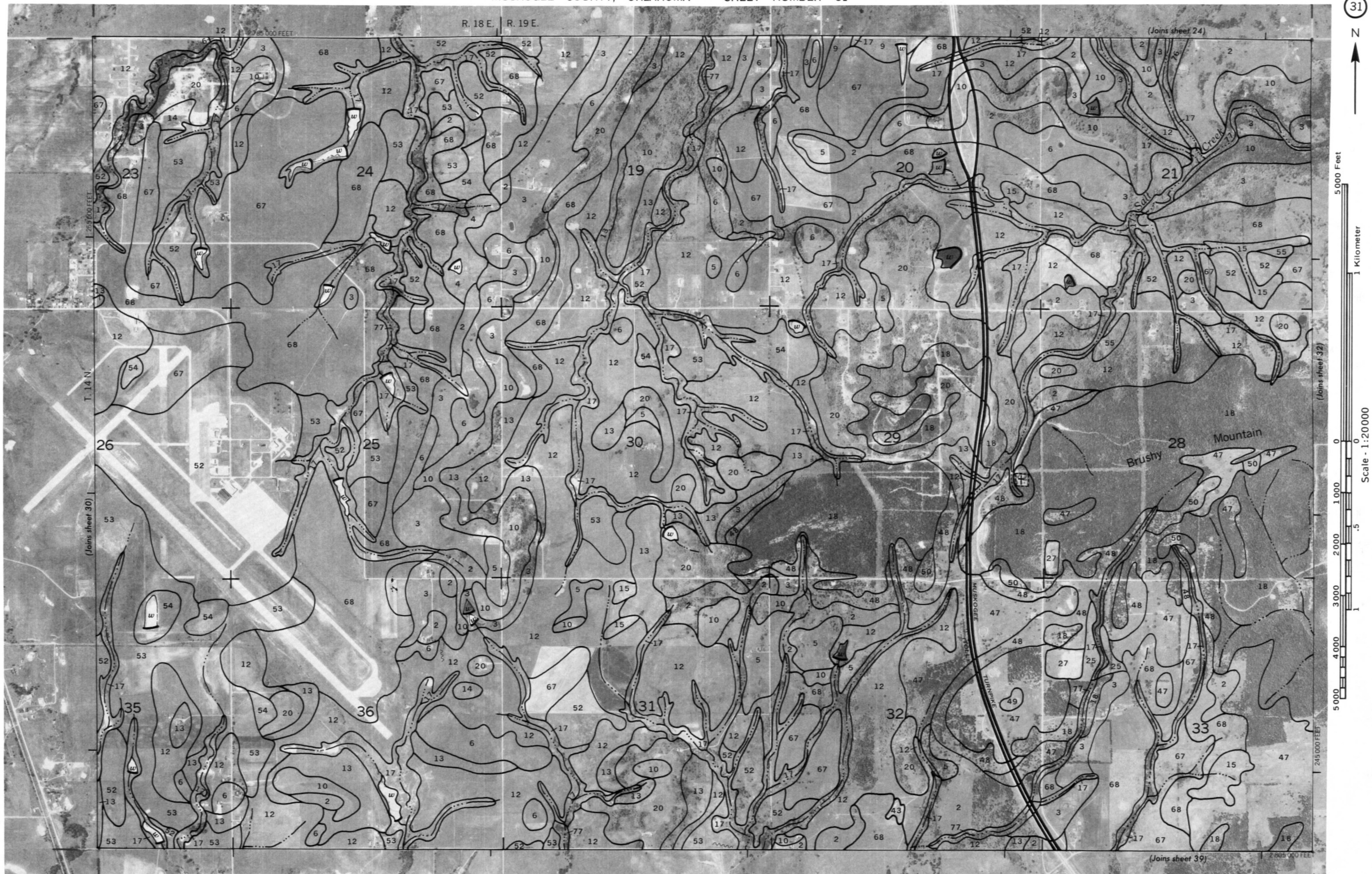

R. 15 E.
R. 16 E.
T. 14 N.
2 690 000 FEET
2 710 000 FEET
285 000 FEET
245 000 FEET
(Joins sheet 20)
(Joins sheet 28)
(Joins sheet 35)
(Joins inset, sheet 19)
Boynton
Boynton Lake
Cloud Creek
SEWAGE LAGOON
water
N
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 21)
R. 16 E.
R. 17 E.
2 730 000 FEET
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 36)
2 715 000 FEET
245 000 FEET
255 000 FEET
T. 14 N.
Bartley
Flusche
water
GULF
AND
OKLAHOMA
KANSAS


29
N
(Joins sheet 22)
R. 17 E.
2 735 000 FEET
T. 14 N.
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 37)
2 755 000 FEET
FISH HATCHERY
water
Chimney Mountain
69
5 000 Feet
1 Kilometer
Scale - 1:20000

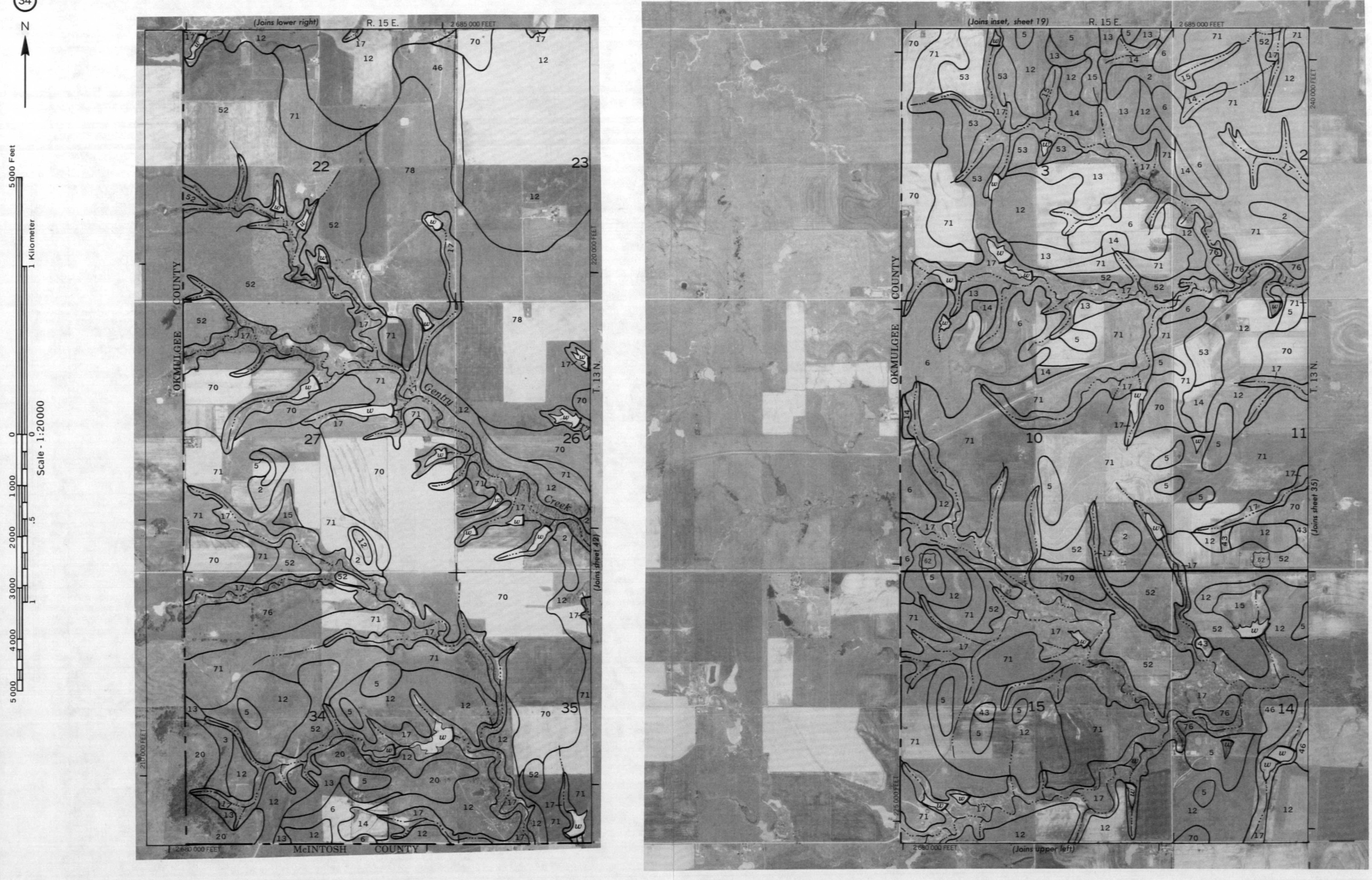

N
(Joins sheet 23)
R. 18 E.
2 780 000 FEET
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 38)
T. 14 N.
Summit
Butler Creek
MISSOURI KANSAS TEXAS
MISSOURI PACIFIC
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
5 000 Feet
1 Kilometer
Scale 1:20000
0
1000
2000
3000
4000
5000
.5
1

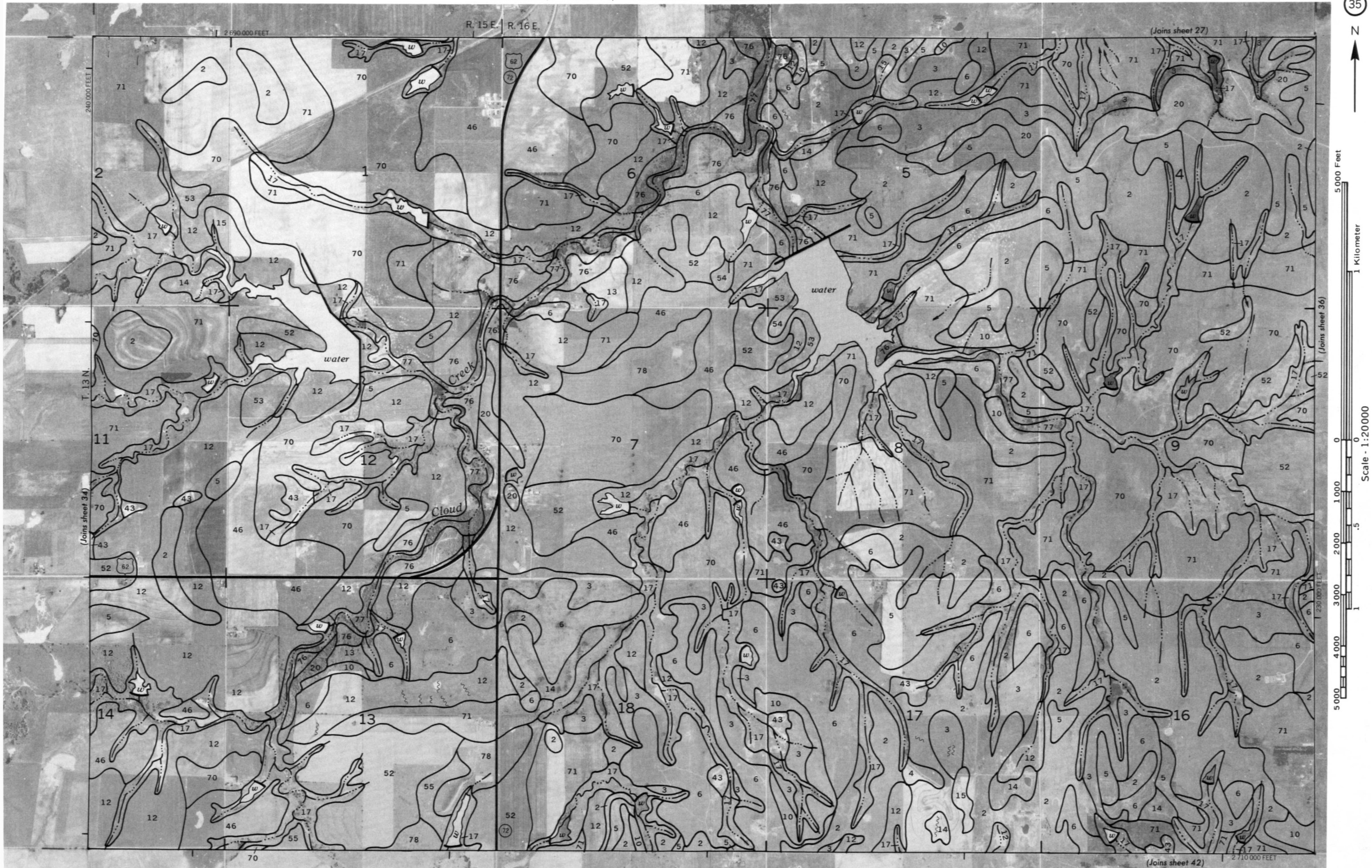
MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 31



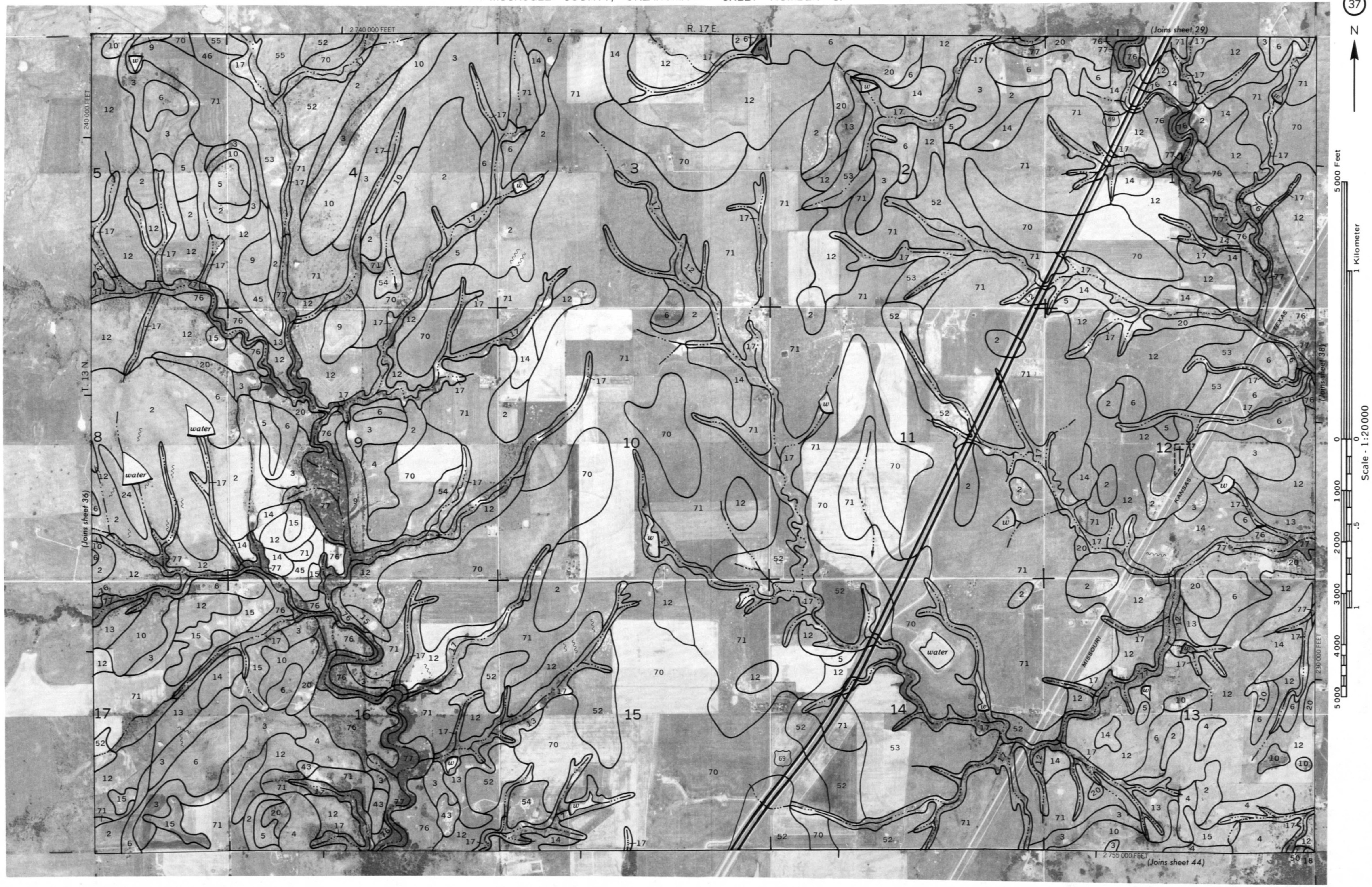

32
N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 25)
R. 19 E.
R. 20 E.
2 825 000 FEET
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 40)
2 810 000 FEET
245 000 FEET
T. 14 N.
Salt Creek
Brushy Mountain
WEBBERS FALLS RESERVOIR
ARKANSAS RIVER
STAR LAKE
Sand Creek
Joe Branch
MISSOURI PACIFIC

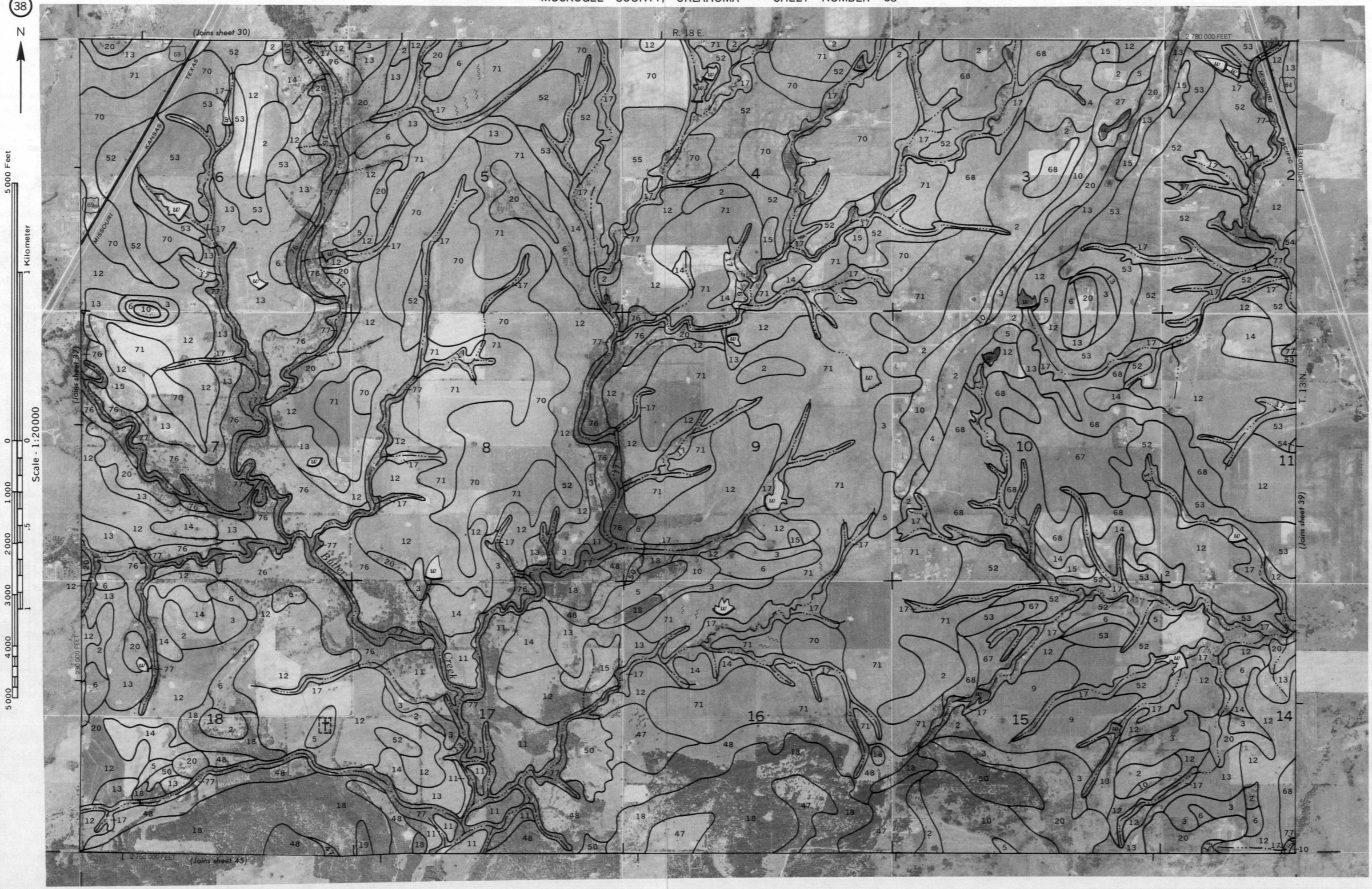

33
N
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 41)
R. 20 E.
T. 14 N.
2 830 000 FEET
2 850 000 FEET
Braggs
MISSOURI
PACIFIC
Greenleaf
Creek
Little
Sand
GREENLEAF LAKE STATE PARK
GREENLEAF LAKE
CHEROKEE COUNTY
5000 Feet
1 Kilometer
Scale - 1:20000


34
N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins lower right)
R. 15 E.
2 685 000 FEET
220 000 FEET
210 000 FEET
2 680 000 FEET
OKMULGEE COUNTY
McINTOSH COUNTY
T. 13 N.
(Joins sheet 42)
Gentry
Creek
22
23
27
26
34
35
(Joins inset, sheet 19)
2 685 000 FEET
240 000 FEET
225 000 FEET
2 680 000 FEET
(Joins upper left)
(Joins sheet 35)
3
2
10
11
15
14

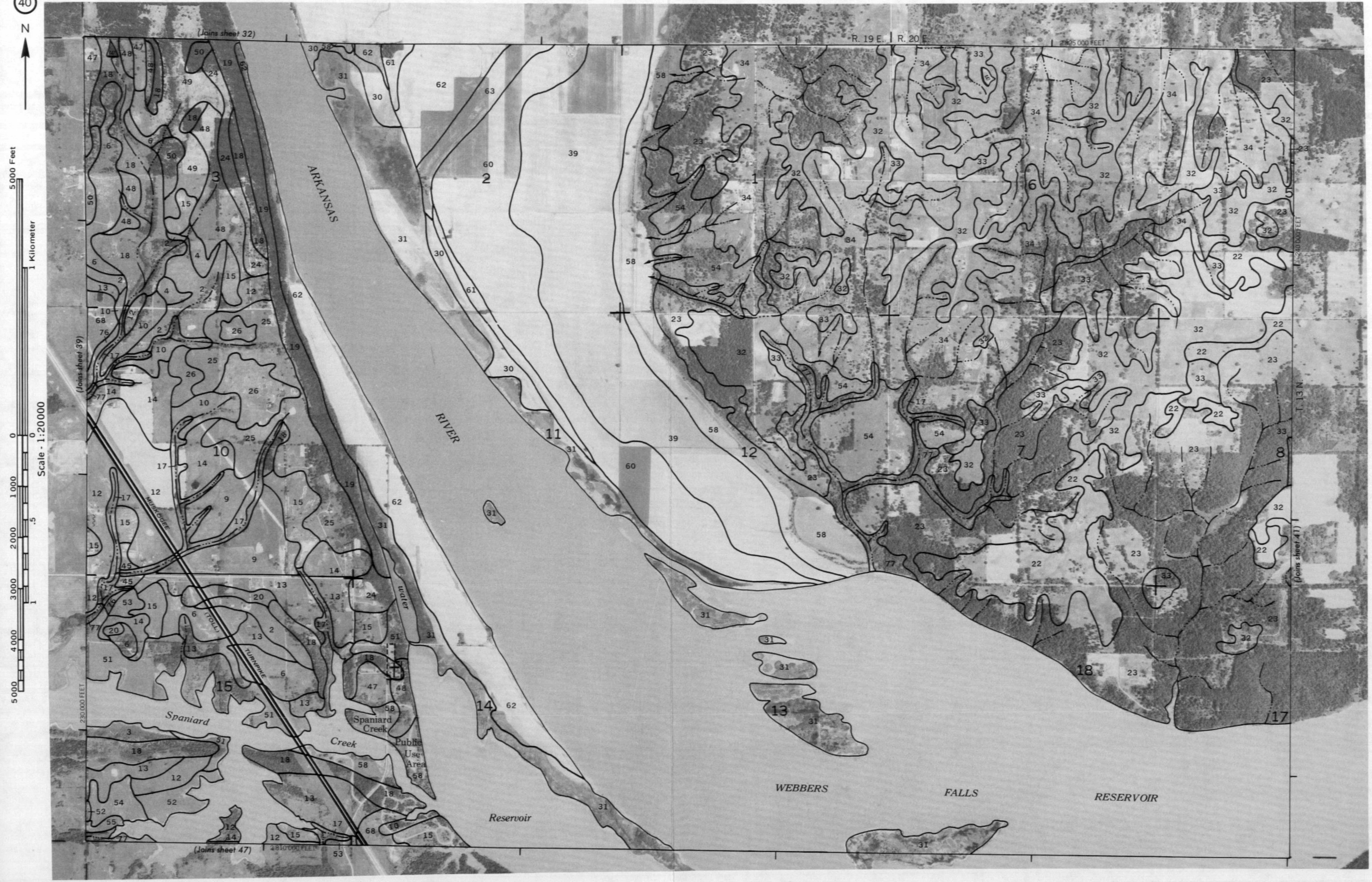

(Joins sheet 27)
(Joins sheet 36)
(Joins sheet 42)
(Joins sheet 34)
R. 15 E.
R. 16 E.
T. 13 N.
2 690 000 FEET
2 710 000 FEET
240 000 FEET
230 000 FEET
water
Cloud
Creek
N
5000 Feet
1 Kilometer
Scale - 1:20000


36
N
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 43)
R. 16 E. | R. 17 E.
T. 13 N.
2 735 000 FEET
2 715 000 FEET
230 000 FEET
240 000 FEET
Wainwright
Anderson
Creek
GULF
AND
OKLAHOMA
KANSAS
5000 Feet
1 Kilometer
Scale - 1:20000

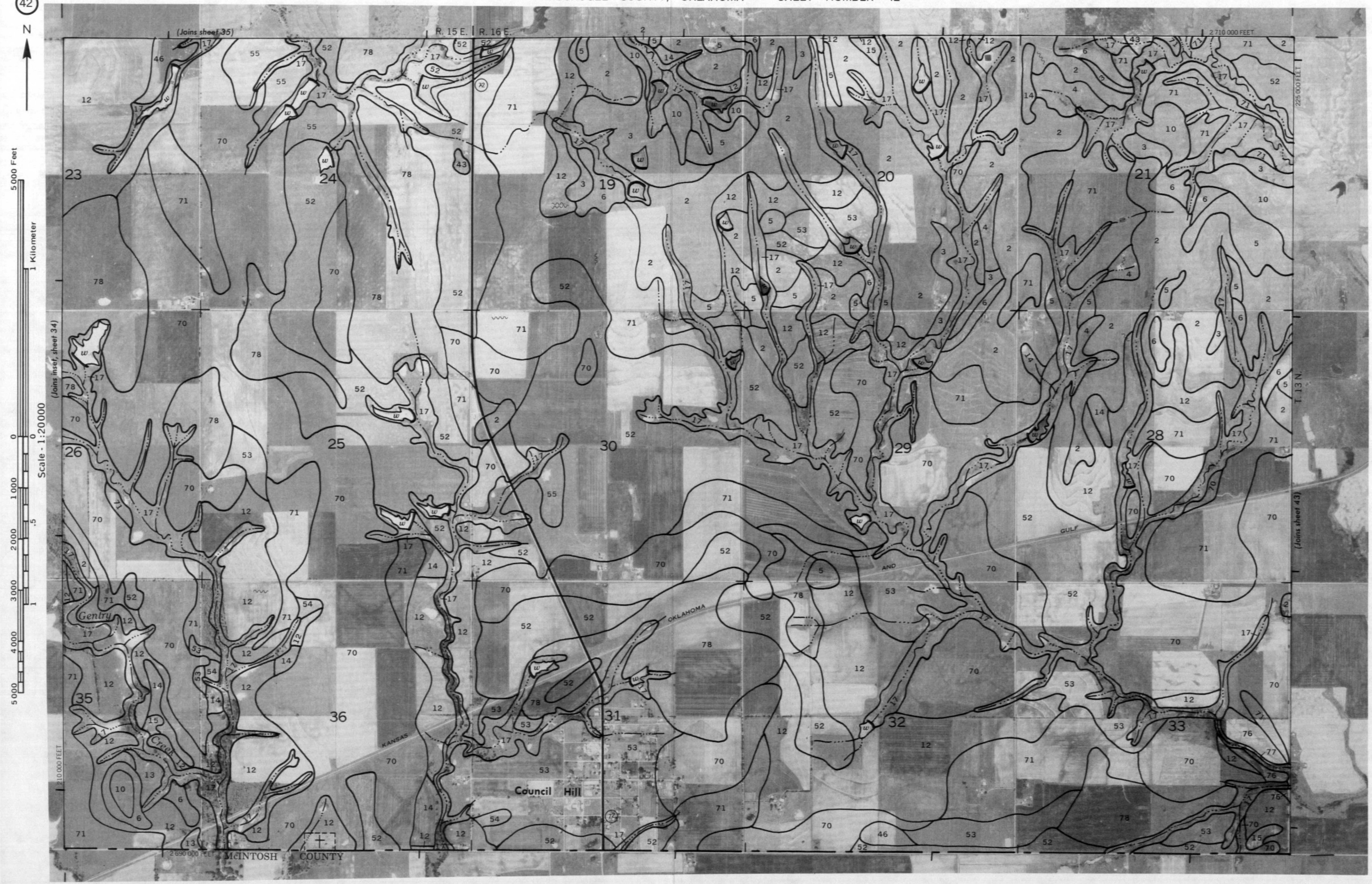

37
N
R. 17 E.
T. 13 N.
2 740 000 FEET
240 000 FEET
230 000 FEET
2 755 000 FEET
(Joins sheet 29)
(Joins sheet 38)
(Joins sheet 44)
(Joins sheet 36)
5000 Feet
1 Kilometer
Scale - 1:20000
water
KANSAS
MISSOURI
TEXAS
69


N
(Joins sheet 30)
R. 18 E.
2 780 000 FEET
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 45)
T. 13 N.
2 760 000 FEET
230 000 FEET
Bitter Creek
MISSOURI KANSAS TEXAS
MISSOURI PACIFIC
5 000 Feet
1 Kilometer
Scale 1:20000

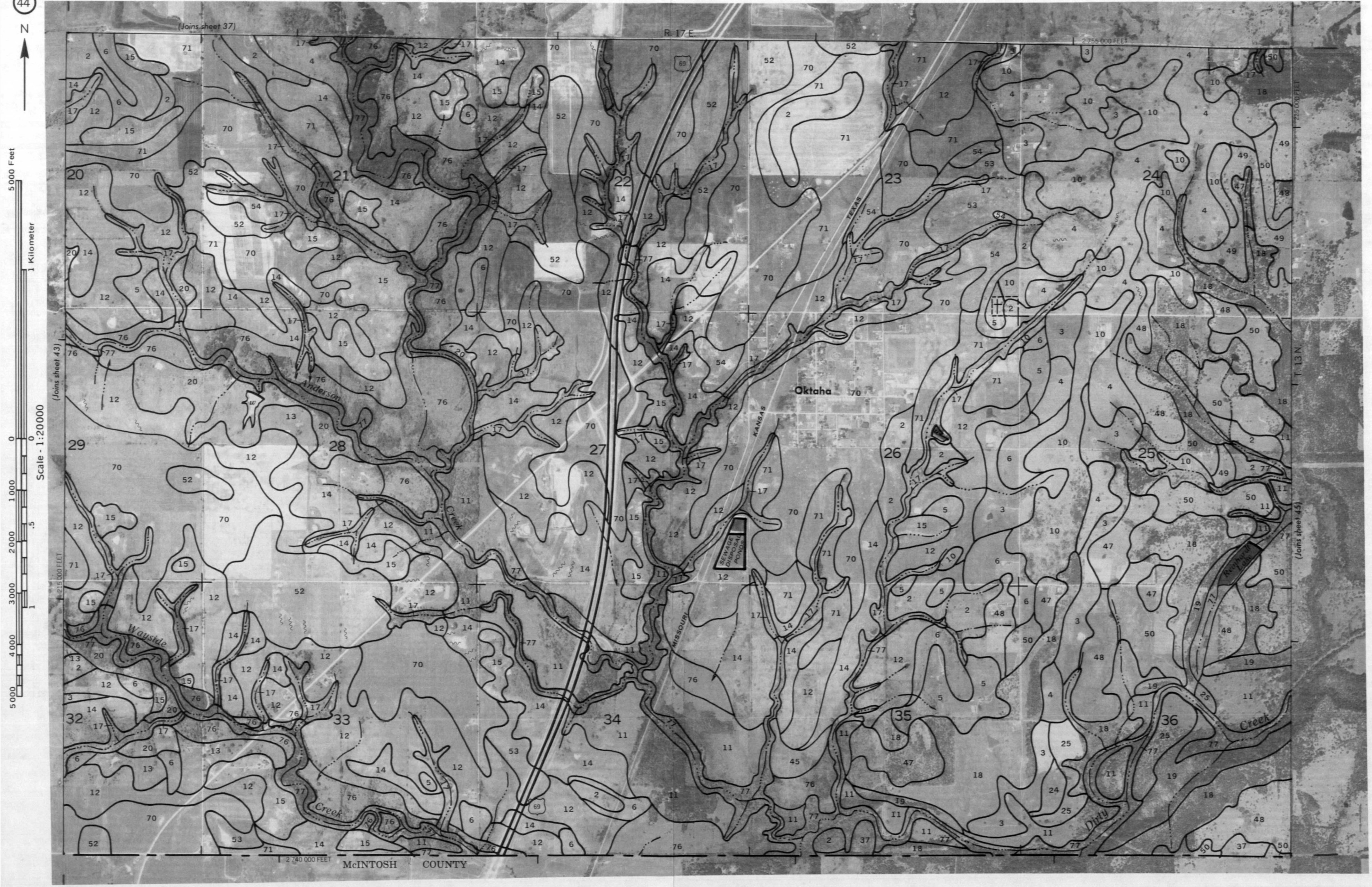

39
N
(Joins sheet 31)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
R. 18 E.
R. 19 E.
T. 13 N.
2 785 000 FEET
2 805 000 FEET
240 000 FEET
230 000 FEET
MISSOURI
PACIFIC
MUSKOGEE
(TOLL)
TURNPIKE
Coal
Creek
Spaniard
Creek
5 000 Feet
1 Kilometer
Scale - 1:20000


N
(Joins sheet 32)
R. 19 E. | R. 20 E.
2 895 000 FEET
ARKANSAS
RIVER
water
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 47)
T. 13 N.
230 000 FEET
2 810 000 FEET
MUSKOGEE
(TOLL)
TURNPIKE
Spaniard
Creek
Spaniard Creek Public Use Area
Reservoir
WEBBERS
FALLS
RESERVOIR
5 000 Feet
1 Kilometer
Scale - 1:20000


(Joins sheet 33)
R. 20 E.
2 830 000 FEET
240 000 FEET
T. 13 N.
(Joins sheet 40)
(Joins sheet 48)
2 850 000 FEET
N
Greenleaf Creek
MISSOURI PACIFIC
GREENLEAF LAKE
STATE PARK
GREENLEAF
LAKE
Deep Branch
Arrowhead
Point Public
Use Area
ARKANSAS RIVER
WEBBERS FALLS RESERVOIR
Brewer Bend
SEQUOYAH COUNTY
5000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 35)
R. 15 E.
R. 16 E.
2 710 000 FEET
225 000 FEET
T. 13 N.
(Joins inset, sheet 34)
(Joins sheet 43)
210 000 FEET
2 690 000 FEET
McINTOSH
COUNTY
Council Hill
Gentry
Creek
KANSAS
OKLAHOMA
AND
GULF

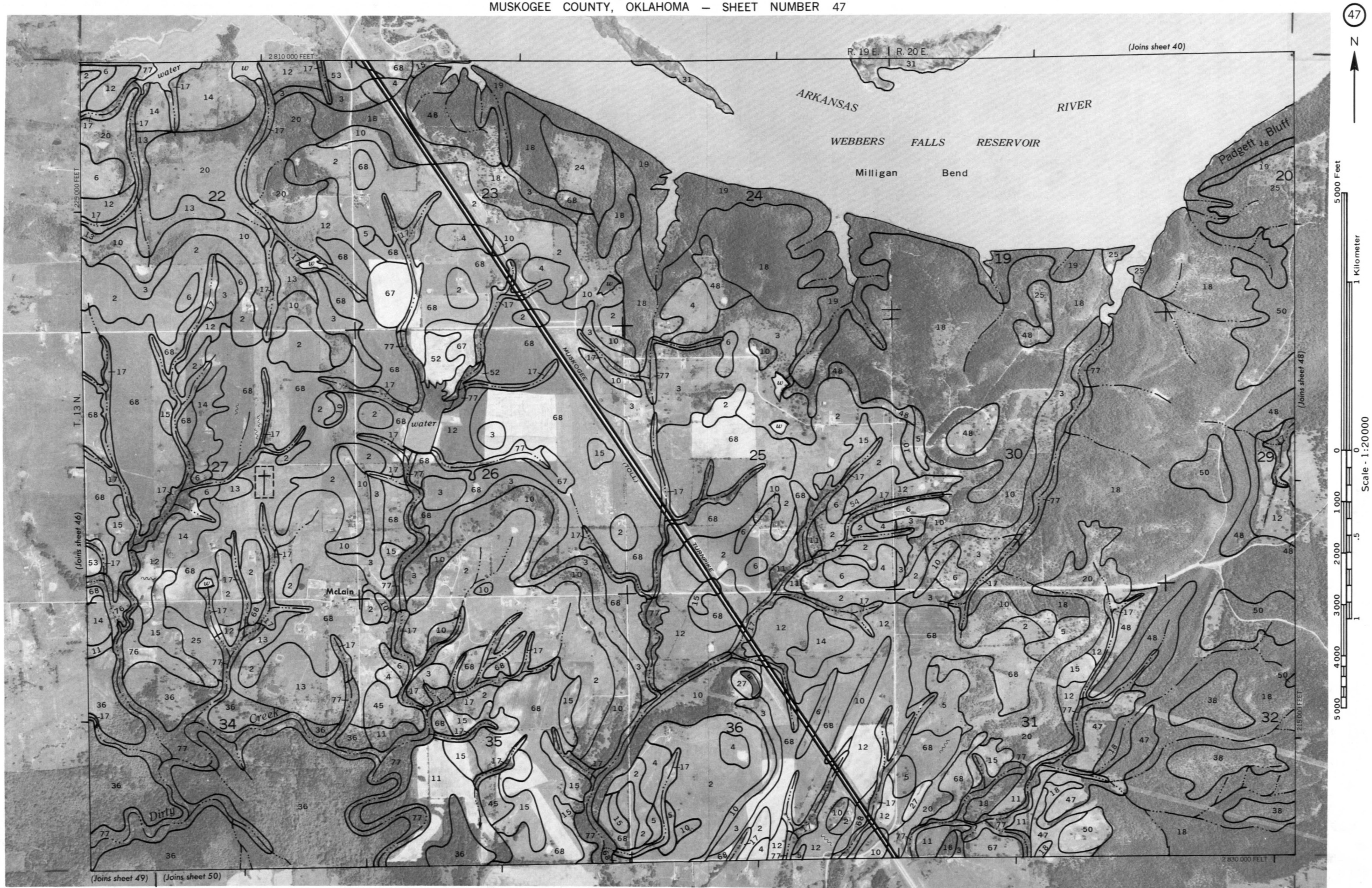

(Joins sheet 36)
(Joins sheet 42)
(Joins sheet 44)
R. 16 E. | R. 17 E.
T. 13 N.
2 715 000 FEET
225 000 FEET
215 000 FEET
2 735 000 FEET
Wayside Creek
Anderson Creek
McINTOSH COUNTY
N
5 000 Feet
1 Kilometer
Scale - 1:20000


N
(Joins sheet 37)
R 17 E.
2 755 000 FEET
(Joins sheet 43)
(Joins sheet 45)
T 13 N.
Oktaha
Anderson
Creek
Wayside
Creek
Dirty
Creek
TEXAS
KANSAS
MISSOURI
SEWAGE DISPOSAL PONDS
Reservoir Lake
McINTOSH COUNTY
2 740 000 FEET
215 000 FEET
5 000 Feet
1 Kilometer
Scale - 1:20000

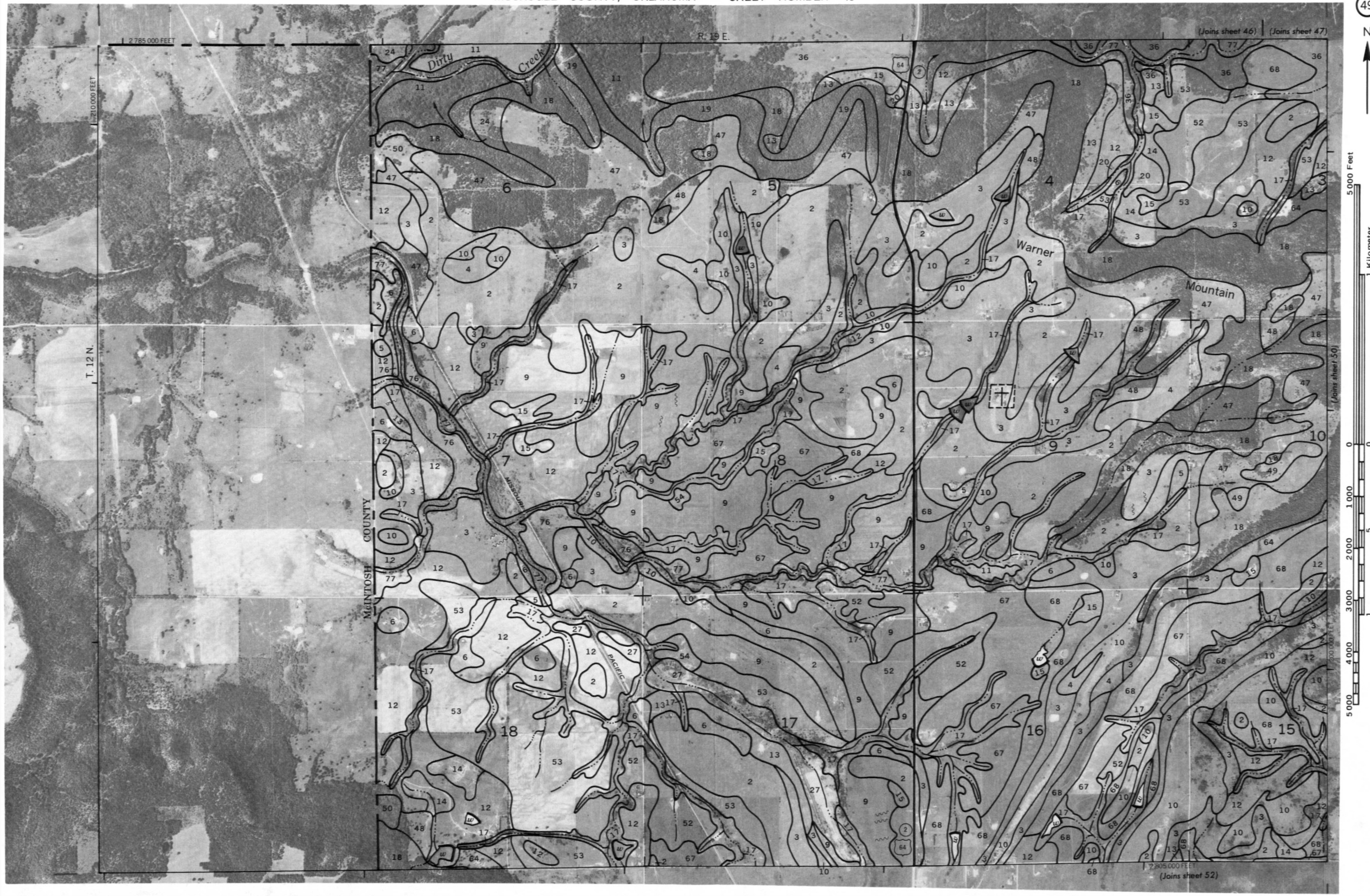

R. 18 E.
(Joins sheet 38)
2 760 000 FEET
225 000 FEET
T. 13 N.
(Joins sheet 44)
(Joins sheet 46)
Butler
Creek
Dirty
Creek
Timberly
Creek
Dirty
McINTOSH COUNTY
2 780 000 FEET
215 000 FEET
N
5000 Feet
1 Kilometer
Scale - 1:20000

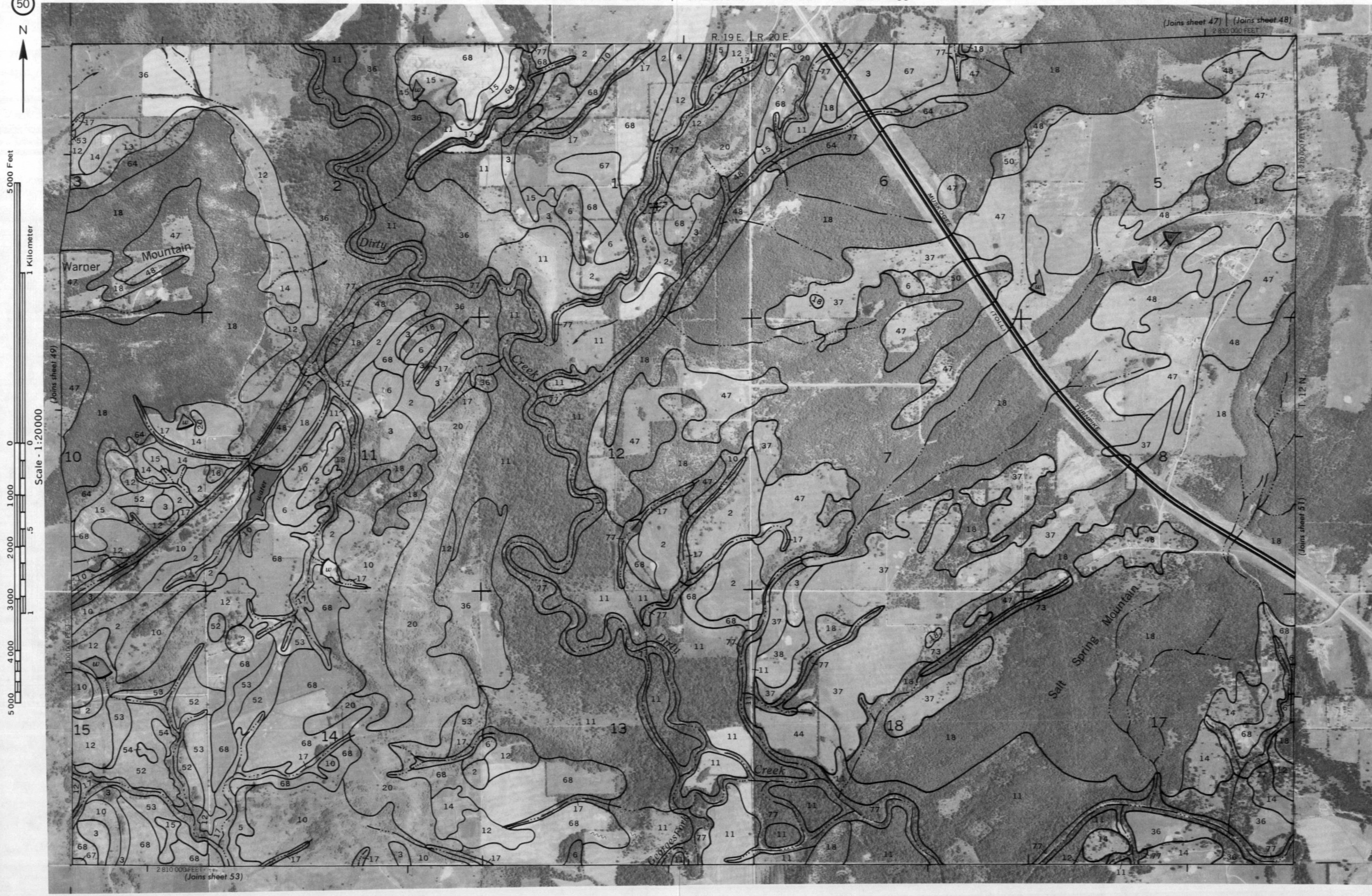

(Joins sheet 39)
R. 18 E.
R. 19 E.
Keefton
Martin
MISSOURI
PACIFIC
Duty
Creek
T. 13 N.
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 49)
McINTOSH COUNTY
2 785 000 FEET
2 805 000 FEET
215 000 FEET
235 000 FEET
N
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1

MUSKOGEE COUNTY, OKLAHOMA — SHEET NUMBER 47



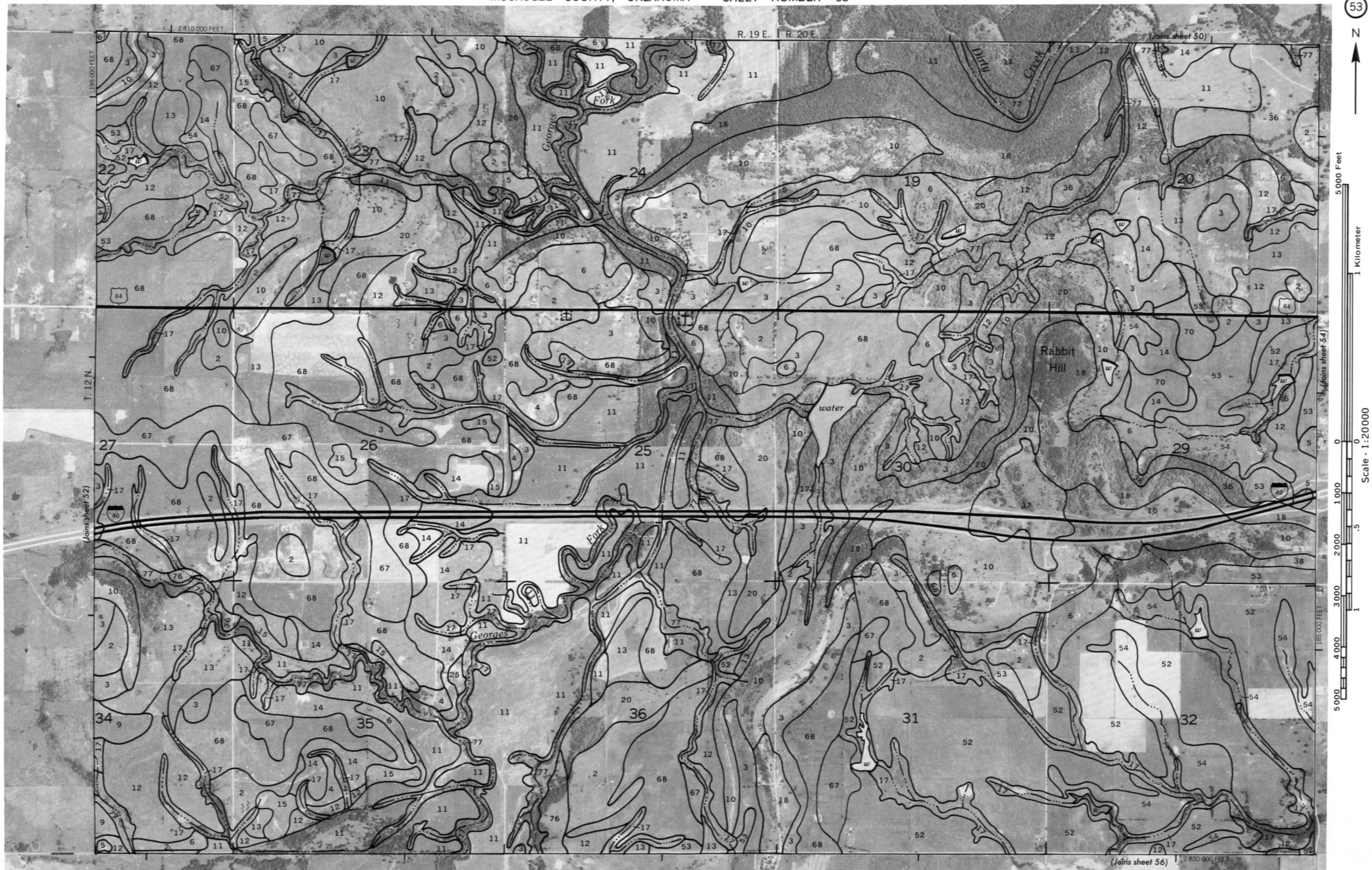

N
5 000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 41)
(Joins sheet 47)
(Joins sheet 50)
(Joins sheet 51)
R. 20 E.
T. 13 N.
SEQUOYAH COUNTY
water
Padgett Bluff
Big Branch
ARKANSAS RIVER
WEBBERS FALLS RESERVOIR
Brewer Bend Public Use Area
Sulphur Branch
Cedar Creek
LOCK AND DAM NO. 16
DAM
MISSOURI PACIFIC
2 635 000 FEET
2 660 000 FEET


2 785 000 FEET
R. 19 E.
(Joins sheet 46)
(Joins sheet 47)
N
210 000 FEET
T. 12 N.
Dirty
Creek
Warner
Mountain
McINTOSH
COUNTY
MISSOURI
PACIFIC
(Joins sheet 50)
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1
2 805 000 FEET
(Joins sheet 52)

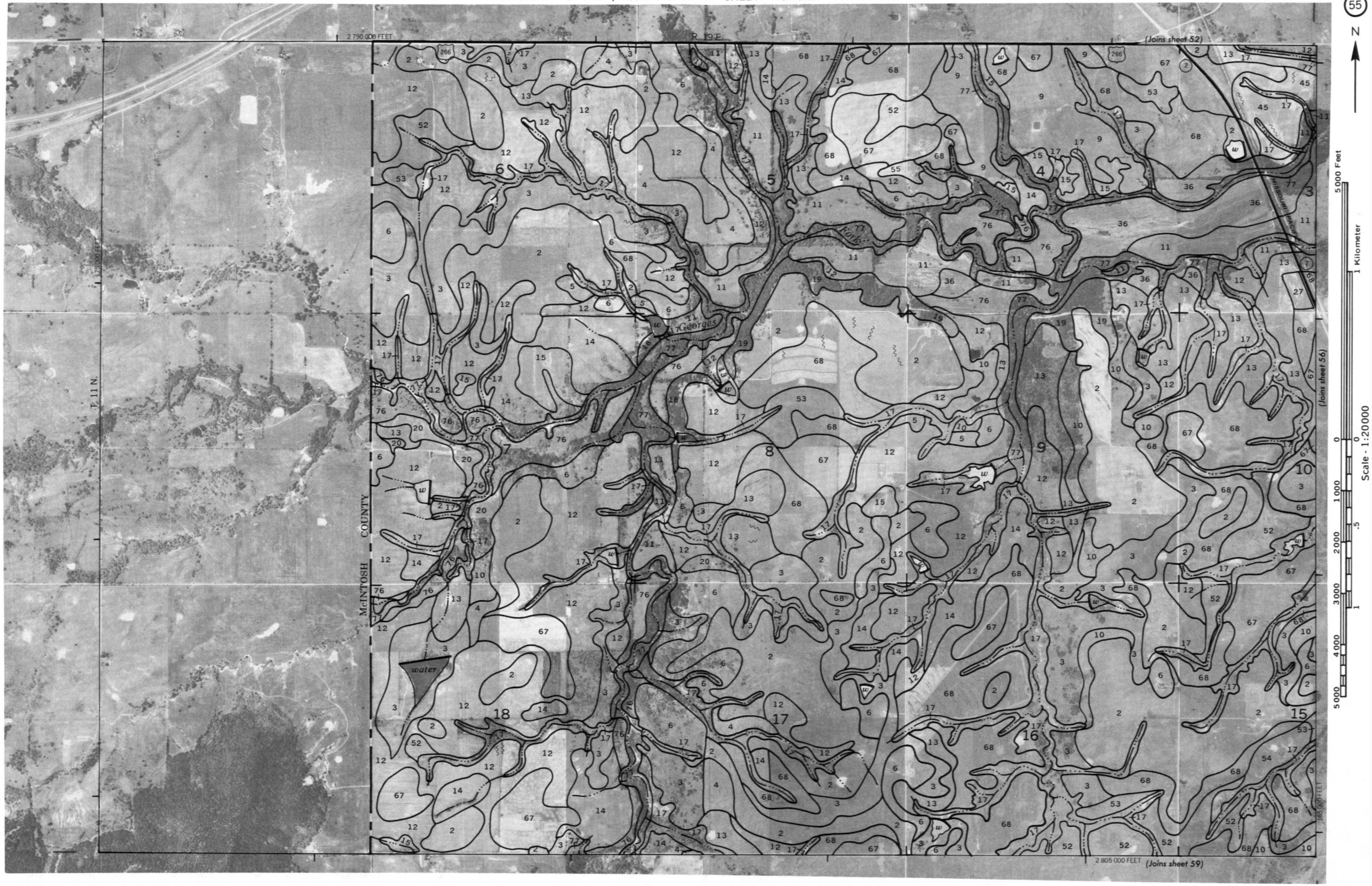

N
5000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5 000
0
.5
1
(Joins sheet 47)
(Joins sheet 48)
2 830 000 FEET
R. 19 E.
R. 20 E.
T. 12 N.
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 53)
2 810 000 FEET
Warner
Mountain
Dirty
Creek
Dirty
Creek
Salt
Spring
Mountain
MUSKOGEE
TOLL
TURNPIKE
water
Georges Fork


51
N
(Joins sheet 48)
R. 20 E.
R. 20 E. | R. 21 E.
2 885 000 FEET
210 000 FEET
T. 12 N.
(Joins sheet 50)
ROBERT S. KERR
ARKANSAS
RESERVOIR
RIVER
MISSOURI
PACIFIC
Taylor
Creek
SEQUOYAH COUNTY
SEQUOYAH
COUNTY
Dog
Branch
Tiener
Branch
MUSKOGEE
TURNPIKE
TOLL
Webbers Falls
water
200 000 FEET
2 855 000 FEET
(Joins sheet 54)
5 000 Feet
1 Kilometer
Scale - 1:20000

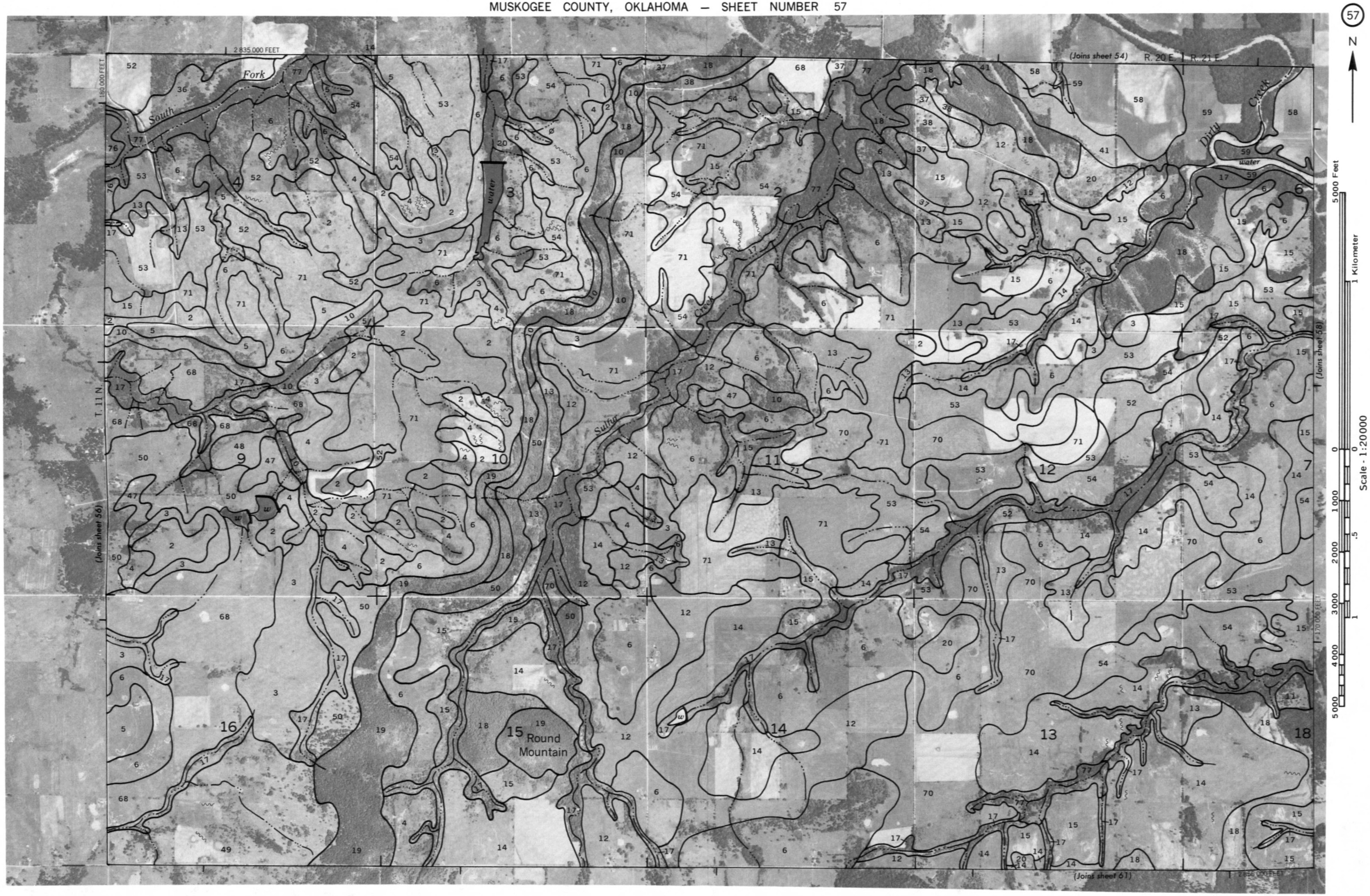

N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 49)
R. 19 E.
2 800 000 FEET
195 000 FEET
Rattlesnake Mountains
McINTOSH COUNTY
SEWAGE DISPOSAL POND
MISSOURI
PACIFIC
Warner
water
T. 12 N.
(Joins sheet 53)
180 000 FEET
2 790 000 FEET
(Joins sheet 55)

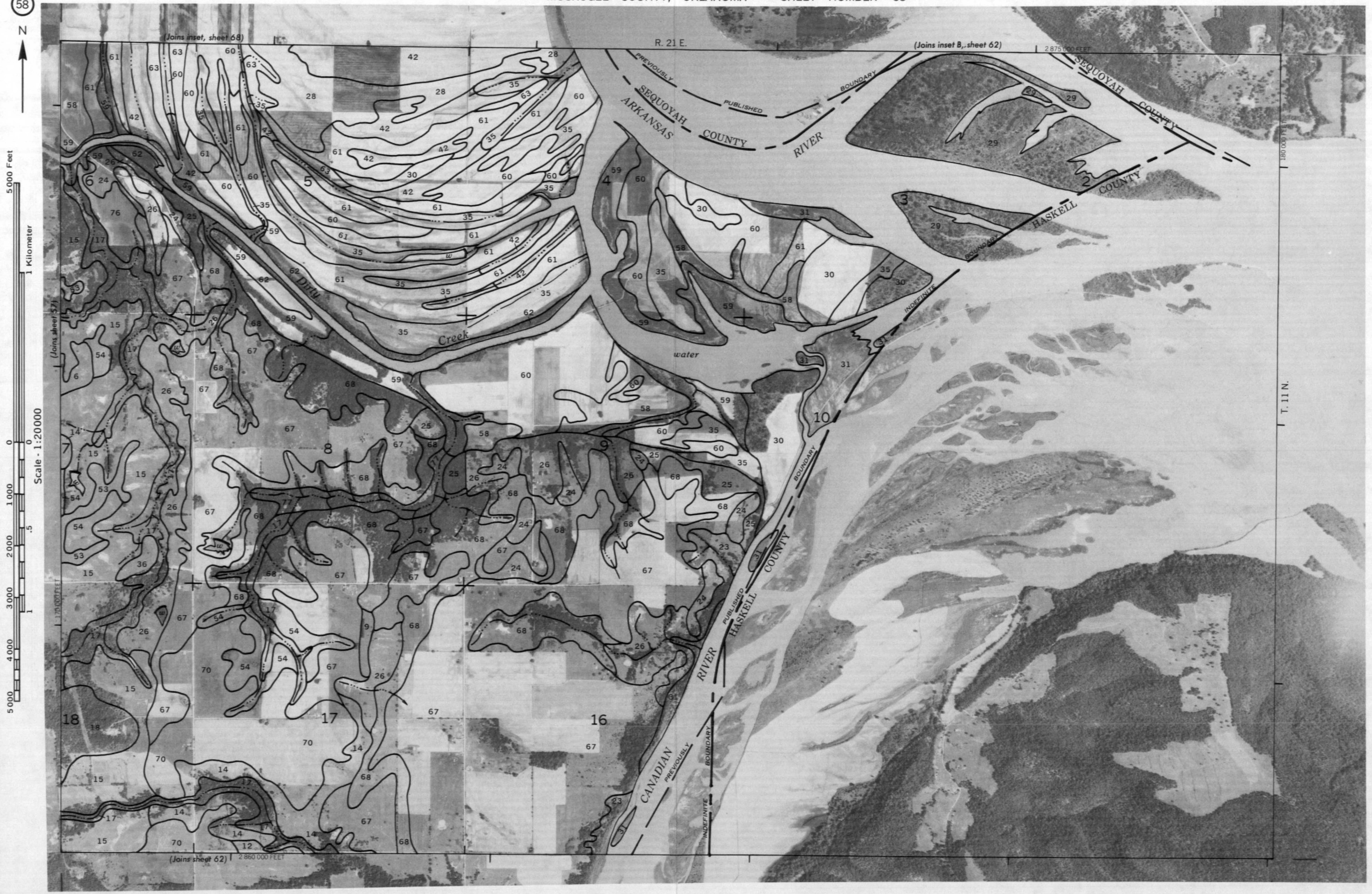

53
N
(Joins sheet 50)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 52)
R. 19 E.
R. 20 E.
T. 12 N.
2 810 000 FEET
2 830 000 FEET
195 000 FEET
185 000 FEET
Dirty Creek
Georges Fork
Rabbit Hill
water
5000 Feet
1 Kilometer
Scale - 1:20000

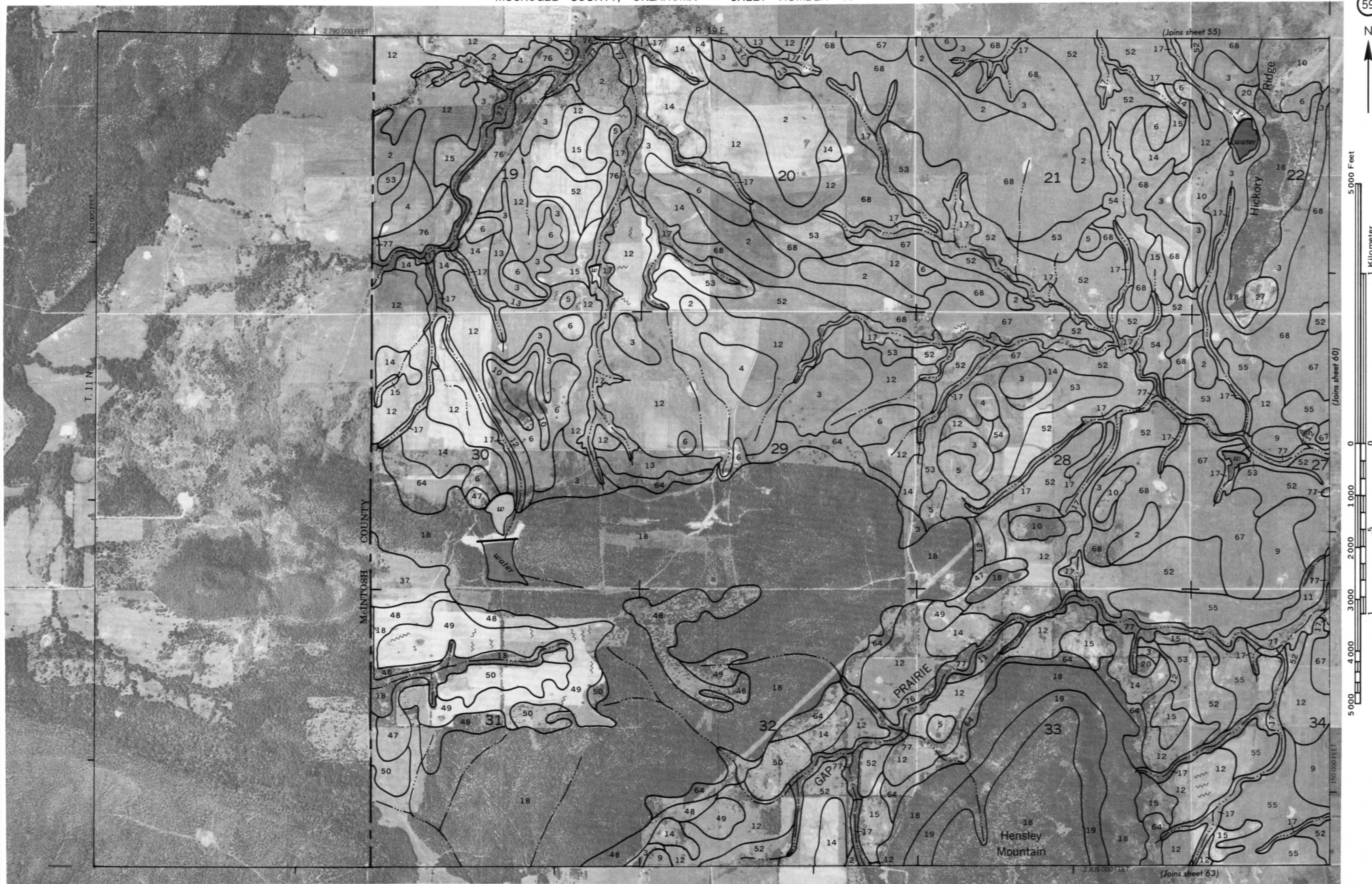

54
N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 57)
(Joins inset, sheet 68)
R. 20 E. | R. 21 E.
T. 12 N.
Dirty Creek
South Fork
Gritts Hill
water
TURNPIKE
MUSKOGEE
TOLL


(Joins sheet 52)
(Joins sheet 56)
(Joins sheet 59)
R. 19 E.
T. 11 N.
McINTOSH COUNTY
2 790 000 FEET
2 805 000 FEET
water
Georges
Fork
N
5 000 Feet
1 Kilometer
Scale - 1:20 000
0
1000
2000
3000
4000
5000
.5
1

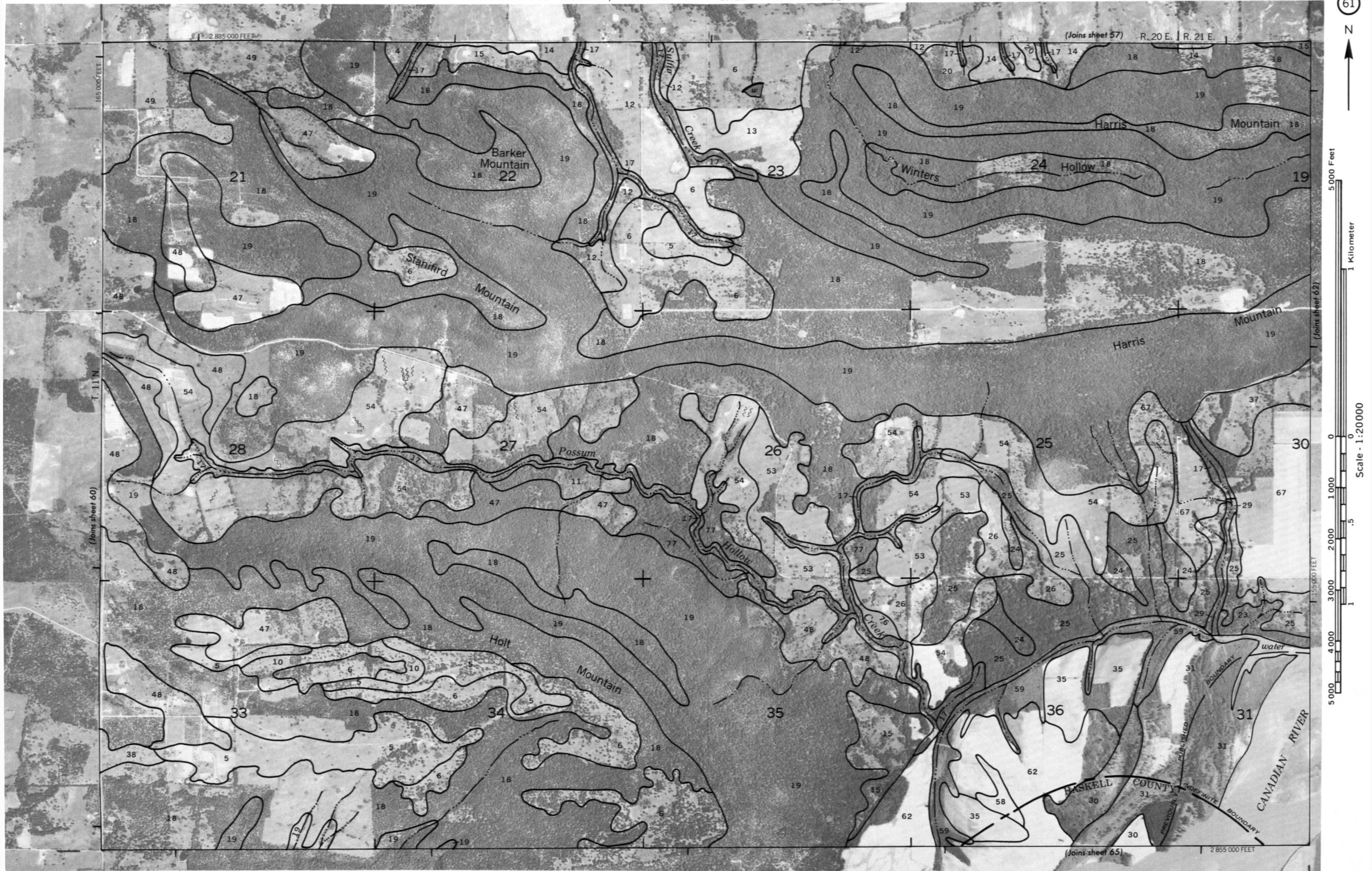

N
5000 Feet
1 Kilometer
Scale 1:20000
(Joins sheet 53)
R. 19 E.
R. 20 E.
2 830 000 FEET
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 60)
2 810 000 FEET
T. 13 N.
Georges
Fork
South
Fork
South
MISSOURI
PACIFIC
water
water
water


57
N
2 835 000 FEET
180 000 FEET
(Joins sheet 54)
R. 20 E.
R. 21 E.
T. 11 N.
(Joins sheet 56)
(Joins sheet 58)
(Joins sheet 61)
2 850 000 FEET
170 000 FEET
South Fork
Dirty Creek
Sulfur Creek
water
Round Mountain
5000 Feet
1 Kilometer
Scale - 1:20000

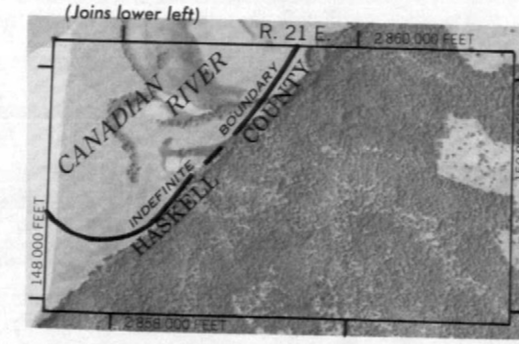

N
5000 Feet
1 Kilometer
Scale - 1:20000
(Joins inset, sheet 68)
R. 21 E.
(Joins inset B, sheet 62)
2 875 000 FEET
SEQUOYAH COUNTY
PREVIOUSLY PUBLISHED BOUNDARY
ARKANSAS RIVER
HASKELL COUNTY
INDEFINITE BOUNDARY
Dirty Creek
water
T. 11 N.
180 000 FEET
(Joins sheet 57)
170 000 FEET
CANADIAN RIVER
(Joins sheet 62)
2 860 000 FEET


(Joins sheet 55)
(Joins sheet 60)
(Joins sheet 63)
R. 19 E.
T. 11 N.
McINTOSH COUNTY
Hickory
Ridge
PRAIRIE
GAP
Hensley
Mountain
water
N
5 000 Feet
1 Kilometer
Scale - 1:20000

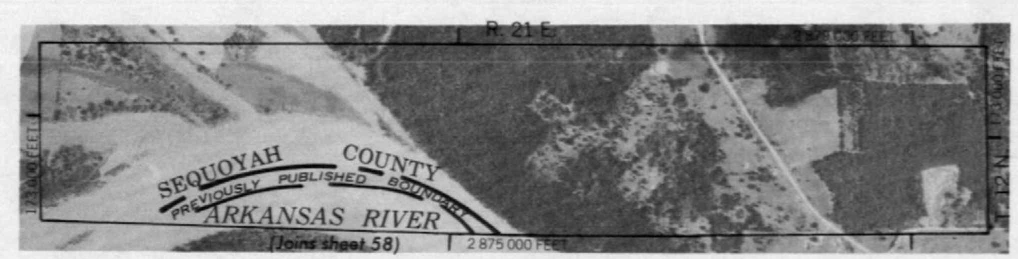

N
(Joins sheet 56)
(Joins sheet 64)
(Joins sheet 59)
(Joins sheet 61)
R. 19 E. R. 20 E.
T. 11 N.
2 830 000 FEET
2 810 000 FEET
165 000 FEET
150 000 FEET
Scale - 1:20000
5 000 Feet
1 Kilometer
South Fork
Sizemore Creek
MISSOURI PACIFIC
water

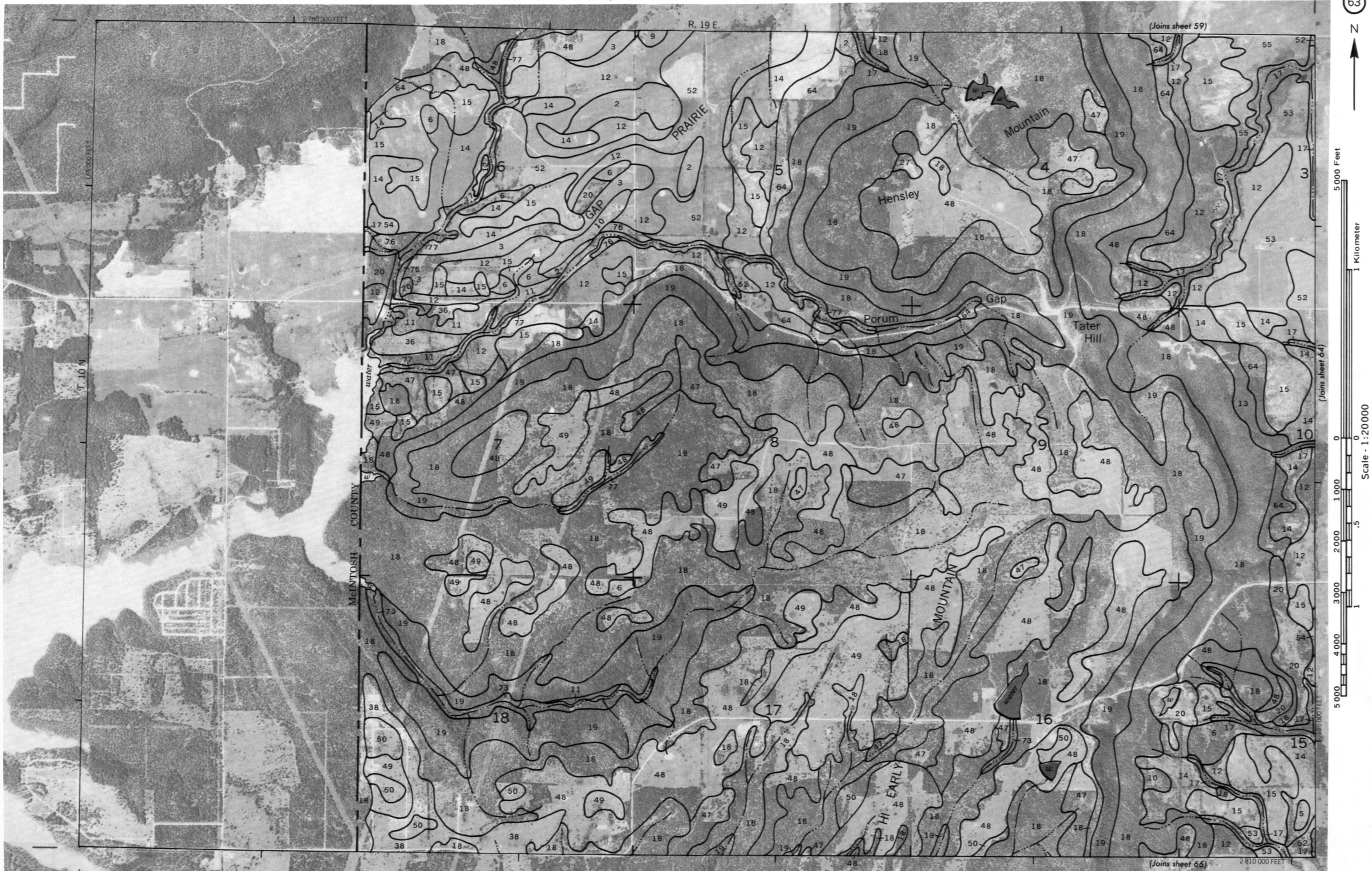

61
N
(Joins sheet 57)
R. 20 E. | R. 21 E.
(Joins sheet 60)
(Joins sheet 62)
(Joins sheet 65)
T. 11 N.
2 835 000 FEET
2 855 000 FEET
165 000 FEET
155 000 FEET
Barker Mountain
Stanifird Mountain
Harris Mountain
Winters Hollow
Sulfur Creek
Possum Hollow Creek
Holt Mountain
HASKELL COUNTY
CANADIAN RIVER
water
PREVIOUSLY PUBLISHED INDEFINITE BOUNDARY
5000 Feet
1 Kilometer
Scale - 1:20000

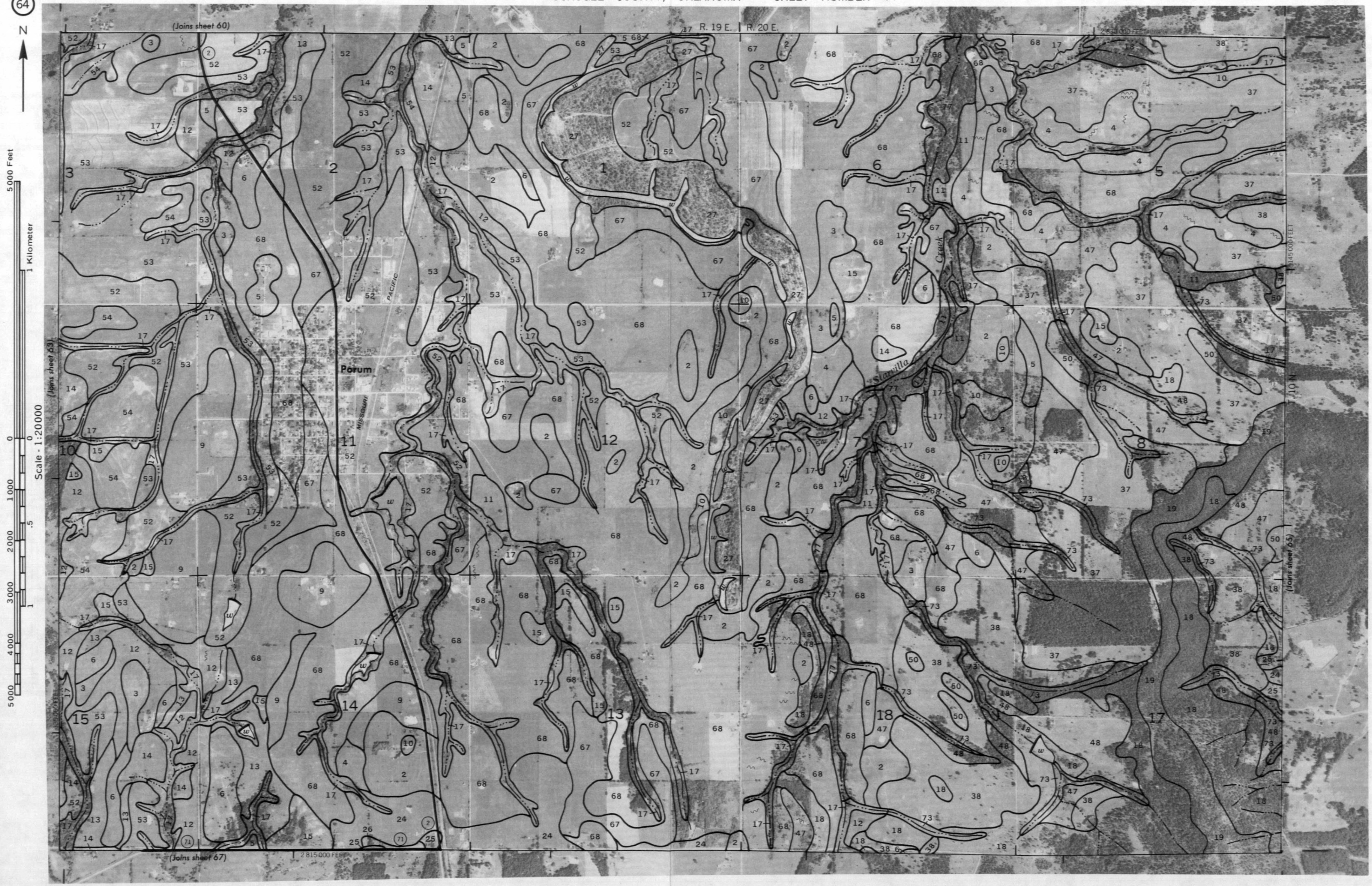
INSET A

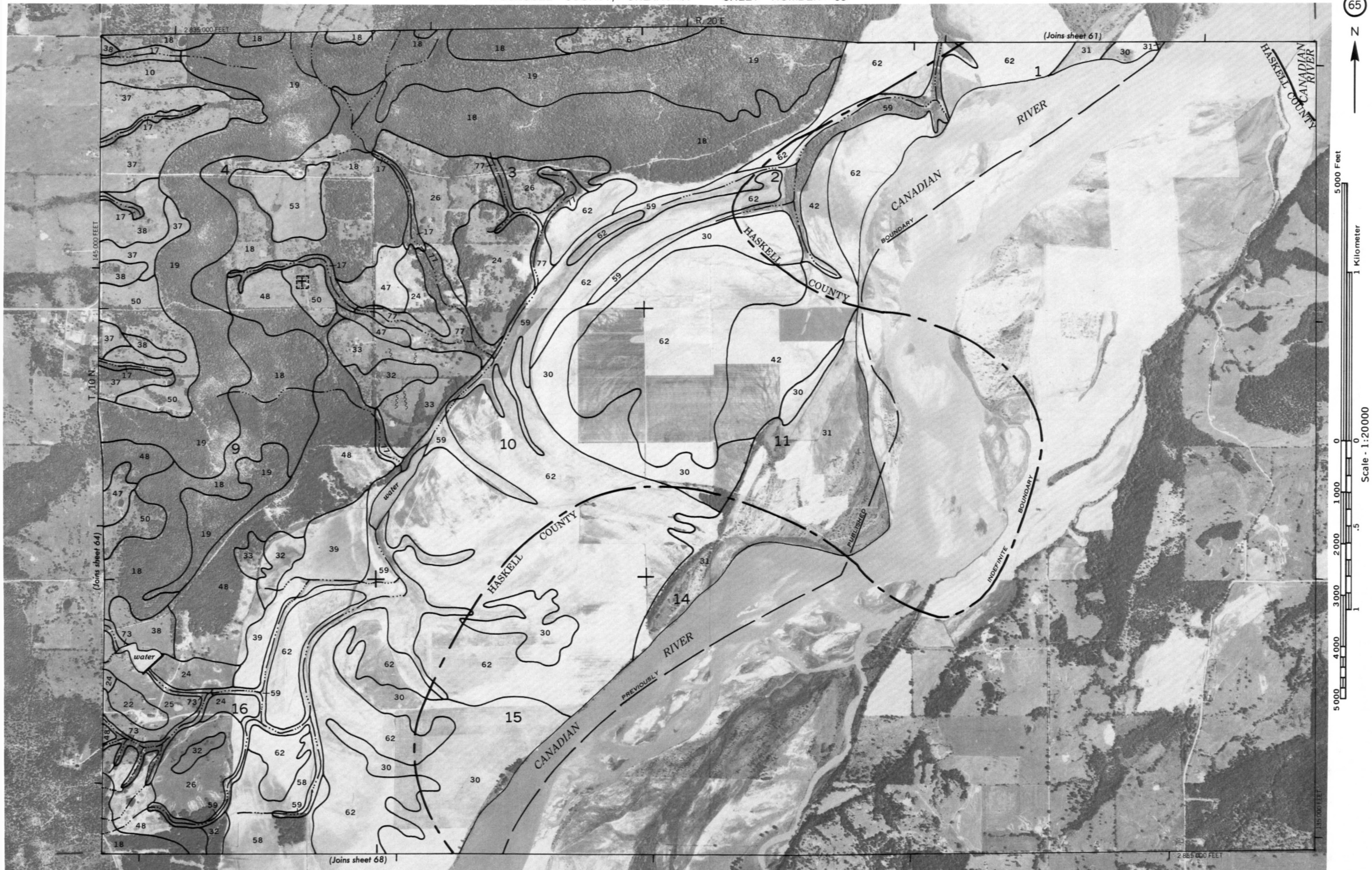


INSET B



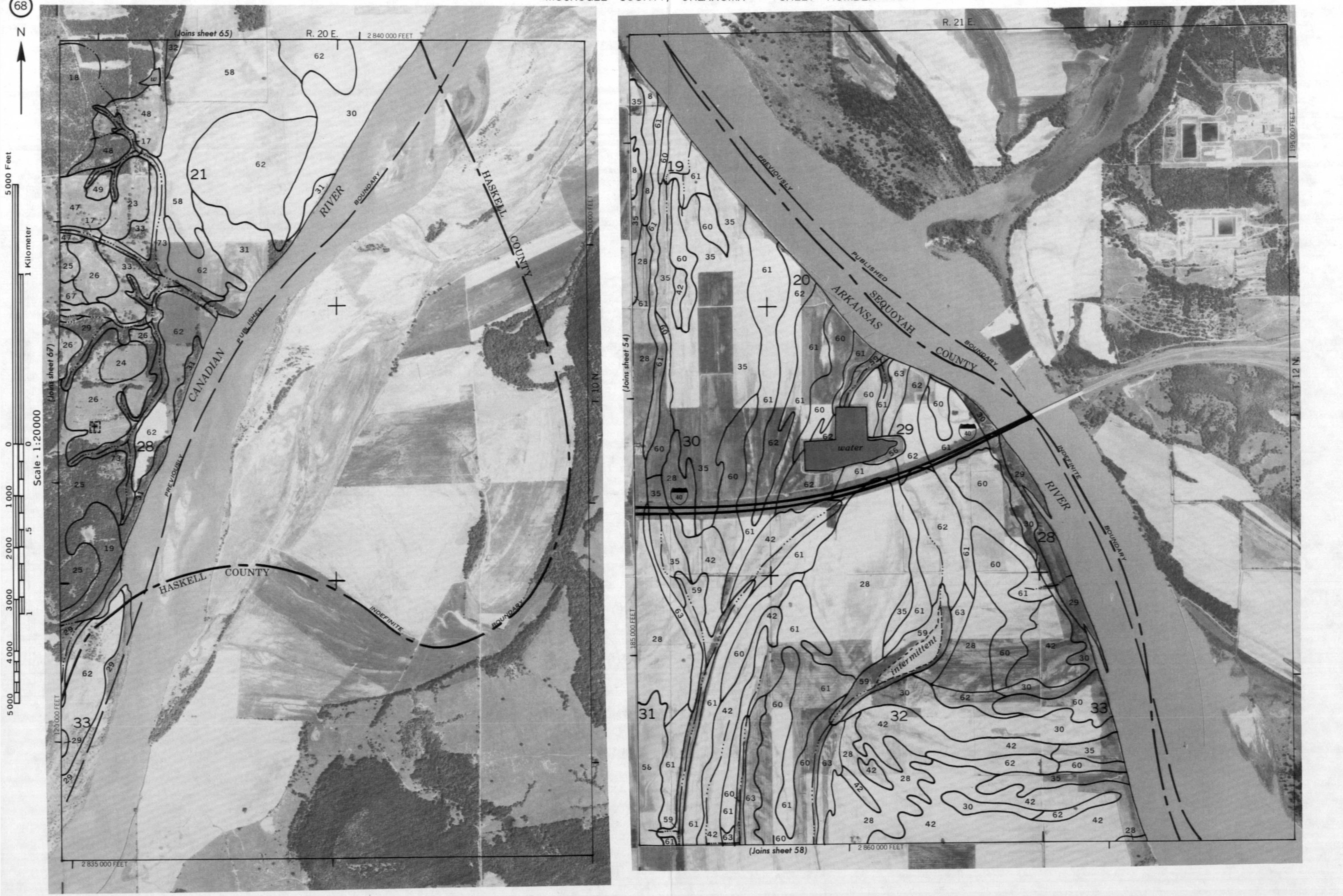

R. 19 E.
(Joins sheet 59)
(Joins sheet 64)
(Joins sheet 66)
T. 10 N.
McINTOSH COUNTY
PRAIRIE
GAP
Hensley
Mountain
Porum
Gap
Tater
Hill
MOUNTAIN
HI EARLY
water
N
Scale - 1:20000
5000 Feet
1 Kilometer


64
N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 60)
R. 19 E.
R. 20 E.
Porum
MISSOURI PACIFIC
Starvilla Creek
(Joins sheet 63)
(Joins sheet 65)
(Joins sheet 67)
T. 10 N.


(Joins sheet 61)
(Joins sheet 64)
(Joins sheet 68)
R. 20 E.
T. 10 N.
2 835 000 FEET
145 000 FEET
2 865 000 FEET
CANADIAN RIVER
HASKELL COUNTY
CANADIAN RIVER
HASKELL COUNTY
CANADIAN RIVER
BOUNDARY
HASKELL COUNTY
INDEFINITE BOUNDARY
PUBLISHED
CANADIAN RIVER
PREVIOUSLY
water
water
N
5000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 63)
R. 19 E.
2 810 000 FEET
EARLY HILL MOUNTAIN
Belle Starr Creek
McINTOSH COUNTY
HASKELL COUNTY BOUNDARY
INDEFINITE
CANADIAN RIVER
PREVIOUSLY PUBLISHED BOUNDARY
HASKELL COUNTY
INDEFINITE BOUNDARY
CANADIAN RIVER
BOUNDARY
(Joins sheet 67)
10 N.
19
20
21
22
27
28
29
30
31
32
33
34


67
N
R. 19 E.
R. 20 E.
(Joins sheet 64)
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 69)
T. 10 N.
2 815 000 FEET
2 830 000 FEET
MISSOURI
PACIFIC
Briartown
Briartown
Creek
Turkey
Knob
PREVIOUSLY
PUBLISHED
BOUNDARY
CANADIAN
RIVER
HASKELL
COUNTY
HASKELL COUNTY
5 000 Feet
1 Kilometer
Scale - 1:20000


N
5 000 Feet
1 Kilometer
Scale - 1:20000
(Joins sheet 65)
R. 20 E.
2 840 000 FEET
(Joins sheet 67)
CANADIAN RIVER
PREVIOUSLY PUBLISHED BOUNDARY
HASKELL COUNTY
INDEFINITE BOUNDARY
130 000 FEET
120 000 FEET
T. 10 N.
2 835 000 FEET
R. 21 E.
(Joins sheet 54)
PREVIOUSLY PUBLISHED BOUNDARY
ARKANSAS RIVER
SEQUOYAH COUNTY
INDEFINITE BOUNDARY
water
intermittent
195 000 FEET
185 000 FEET
T. 12 N.
(Joins sheet 58)
2 860 000 FEET


69
N
(Joins sheet 67)
R. 19 E. | R. 20 E.
2 815 000 FEET
2 835 000 FEET
115 000 FEET
105 000 FEET
T. 9 N.
CANADIAN RIVER
HASKELL COUNTY
INDEFINITE BOUNDARY
PREVIOUSLY PUBLISHED
BOUNDARY
MISSOURI PACIFIC
5 000 Feet
1 Kilometer
Scale - 1:20000
0
1000
2000
3000
4000
5000
.5
1
62
33
32
24
73
26
21
39
29
30
2
23
1
6
5
12
31
7